International Edition

February 1985 Issue #293
$2.50 USA / $3.00 Canada

73®

Amateur Radio's Technical Journal

A CWC/I Publication

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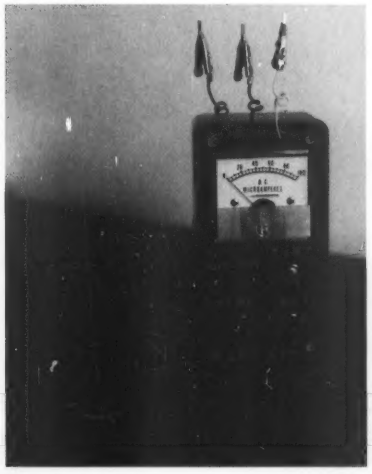

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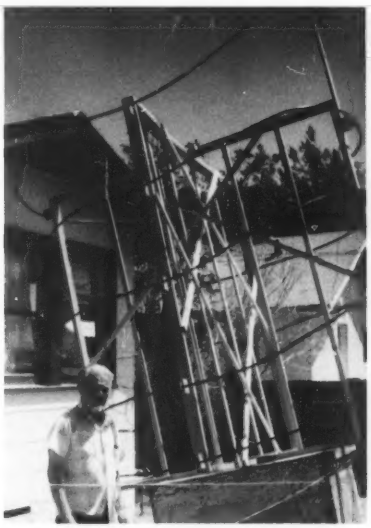

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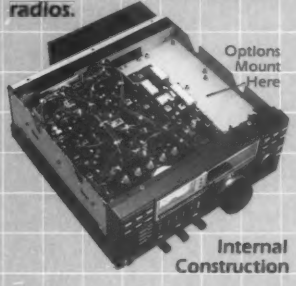

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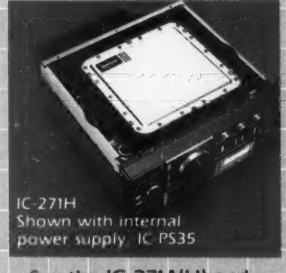

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Editorial Offices:

Pine Street
Peterborough NH 03458
Phone: 603-924-9471

Advertising Offices:

Elm Street
Peterborough NH 03458
Phone: 603-924-7138

Circulation Offices:

Elm Street
Peterborough NH 03458
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Subscription Rates

In the United States and Possessions:
One Year (12 issues) $24.97
Two Years (24 issues) $38.00
Three Years (36 issues) $53.00

Elsewhere:

Canada and Mexico—$27.97/1 year only, U.S. funds. Foreign surface mail—$44.97/1 year only, U.S. funds drawn on U.S. bank. Foreign air mail—$79.97

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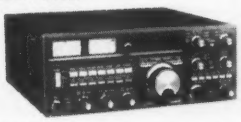

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WHAT?

News from the Publisher

Three things, hopefully. One hundred seventy-one readers have written to me or Wayne about the thinness of *73*. The letters are all pretty much the same. They ask why. The reason is that we have fewer advertisers right now. When our parent company put *73* up for sale late last summer for image reasons (*73* is IDG's only non-computer magazine), and then had the facts of life and rf explained to them, and then switched bands and realized that there will always be *73* readers, a lot of people lost confidence in us.

Who can blame them? I personally don't deal with unstable concerns. Period. Thankfully, though, the murky-swamp, land-mine time for *73* is over. At least until 1990, that is, since our current plans—which include forcing you to help get new hams—don't extend beyond then. Hi.

Which brings us to H-Day, Sunday, March 24, 1985. H-Day means Ham-Day. I am sick and tired of hearing people worrying about ham radio's future. And not doing anything about it. As in doing zero.

H-Day will be your chance. Get psyched. Get on the air that day, and PERSONALLY INVITE SOMEONE TO WATCH. You PERSONALLY ask one other person to share ham radio with you for one hour. Please. Your landlady. A rancher sixty miles away. Someone at work. Your paperboy. Someone you see at the store all the time. SOMEONE will be exposed to amateur radio because of you. Final details next month. In the meantime, PLAN. Yours won't be the last ticket, but unless you—yeah, you—DO SOMETHING, someone else's, someday, will be.

Next month, look for a report on our visit with some super supporters of amateur radio in the Pacific Northwest: AEA, C-COMM, and NYE/VIKING. I'll also try to explain—and I mean try—how the opening of ICOM's new headquarters made Franco Harris's Immaculate Reception seem mundane. Get psyched for H-Day.

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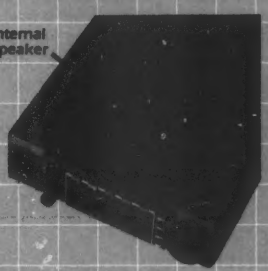
9 Memories. The IC-37A has 9 memories which will store the receive frequency, transmit offset, offset direction and PL tone. All memories are backed up with a lithium battery.

Speech Synthesizer. To verbally announce the receive frequency, an optional UT-16 voice synthesizer is available.

32 PL Frequencies. The IC-37A comes complete with all 32 standard PL frequencies installed. Each PL frequency is selected by turning the main tuning knob, and may be stored into any memory position. Also included is an internal PL level adjustment.

Selecting PL Tone



Internal Speaker. The 25 watt IC-37A super compact mobile contains an internal speaker which makes it easy to mount.

Scanning. The IC-37A has four scanning systems...memory scan, band scan, program scan and priority scan. Priority may be a memory or a VFO channel...and the scanning speed is switchable.

More Features. Other IC-37A standard features include a slide-in mobile mount, IC-HM23 DTMF mic with up/down frequency and memory scan, and internally adjustable transmit power. An optional IC-PS45 slim-line external power supply and IC-SP10 speaker are also available.

See the IC-37A 220MHz mobile at your local ICOM dealer and join the excitement on 220MHz.

ICOM

First in Communications

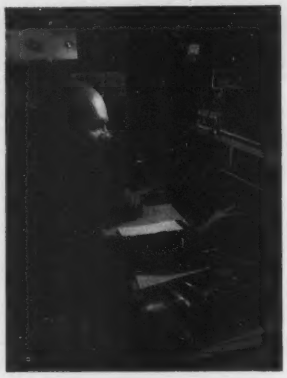
320

ICOM America, Inc., 2380-116th Ave NE, Bellevue, WA 98004 / 3331 Towerwood Drive, Suite 307, Dallas, TX 75234

All stated specifications are approximate and subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions. 37A1184

W2NSD/1
NEVER SAY DIE

editorial by Wayne Green



HAM-DAY

With the electronic, computer, and communications fields jumping ahead, American know-how must really be keeping the Patent Office hopping, right? Just imagine the wealth of American patent applications our labs and research firms must be making—plus those from independent inventors.

I checked with the Patent Office to see how things were going. In 1984, they had 19,677 applications—a bit less than I'd imagined. Of those, only 4,876 were from Americans. And of those, only a small percentage were in electronics and communications—most were consumer products. The fact is, most of the patents approved during the last ten years have been Japanese, not American.

Amateur radio is one of the best high-tech hobbies, so if we can interest more people in getting ham licenses, the chances are that we'll eventually get more scientists, engineers, and technicians—and then more inventions.

The Japanese strength in amateur radio has helped Japan completely defeat America in consumer electronics—ham equipment, CB, hi-fi, VCR, and so on. If we can start generating more hams, perhaps we can hope someday to catch up with Japan. It's going to be tough with their starting out at around four times as many hams as we have, and with half our population!

Okay, how can *you* help? It isn't enough to sit around wringing your hands and cursing the fates—or even cursing the League, if you think that they brought this disaster upon our country, costing us hundreds of billions of dollars and seriously weakening our defense effort. The fact is that YOU can help.

Ham-Day—March 24th—a Sunday. Now, what are you going to do on Ham-Day? You are going to work either by yourself or with your local ham club to expose as many people to amateur radio as you can. This means inviting friends to your home and making some contacts so they'll see what is involved. Clubs can organize group visits to ham shacks—preferably shacks where good DX contacts are possible.

I'm not talking about setting up a table in a mall and taking messages. I don't think I've ever seen a shopping-mall ham demo which the general public could understand. No, people need to see a ham shack in a home and be able to talk with either some DX operators or even to some other similar visitors a few hundred or thousand miles away.

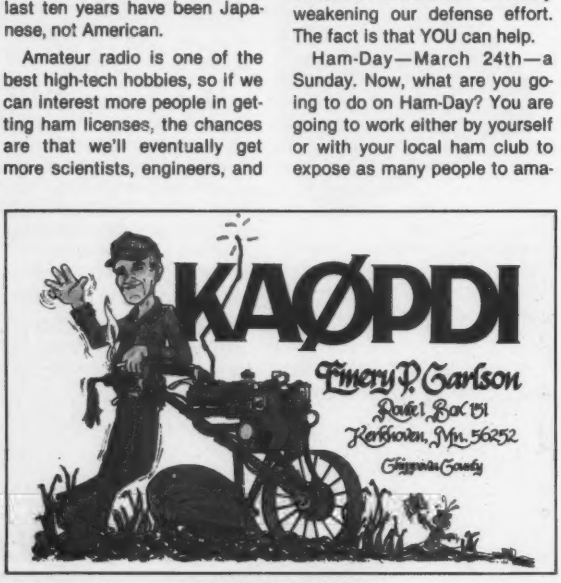
Now, get on the air and make sure that every station you talk with knows that March 24th is *the* day—that whether they are in Swaziland or Newark, they are to plan to be on the air March 24th and have visitors in the shack. Let's make this the biggest visitor's day in the history of the hobby.

You may want to set up some schedules to impress your visitors. Why leave everything up to chance? You know the implacable rules of fate as well as I; everything will go wrong and you'll look like an idiot. Well, why not load the dice with some skeds? It doesn't cost extra.

THE FCC

Did you miss seeing a copy of the article in the *Washington Post* about the Morse code? Pity. It was headlined, "Morse Code Operators Becoming Relics of Past." Makes you really proud to be a relic, right? The article pointed out that except for a few backwaters of communications, Morse has been dead for years.

Continued on page 66



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, 80 Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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KENWOOD

pacesetter in amateur radio

TM-211A DCS... a new turn in 2 meters/70 cm.

TM-211A/411A

The TM-211A 2 meter and the TM-411A 70 cm mobiles combine ultra compact size with the added feature of a 7 position adjustable front panel, allowing you maximum flexibility in both home and automotive installations! These compact transceivers also feature Kenwood's innovative DCS (Digital Code Squelch) circuit, that allows you to program your transceiver to respond only to transmissions from stations whose radios transmit a pre-selected digital code. Both radios deliver 25 big watts of R.F. power on HI and 5 watts (approximately) on LO power. Dual digital VFO's, built-in, highly visible yellow LED display, five memories plus COMM Channel add to this impressive array of features. The TM-211A and TM-411A each boast high performance receive and transmit specifications and an external high quality speaker that provides unsurpassed sound quality. Mounting flexibility is also a feature. Yes, all these features, plus priority watch, memory and programmable band scan, microphone test function, audible "beeper" for operation confirmation, repeater offset switch and reverse switch. The TM-211A and TM-411A offer you the best in 2 meters and 70 cm operations!

Optional accessories:

- CD-10 Call Sign Display
- PS-430 D.C. Power Supply
- KPS-7A Power Supply
- MC-55 Mobile Microphone with Time-Out Timer
- MA-4000 Dual Band Mobile Antenna with Duplexer
- SW-100A/B SWR/Power meters
- PG-3A Noise Filter

More information on these products is available from authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, CA 90220.

CD-10/DCS

The optional CD-10 helps maximize your use of Kenwood's revolutionary new signalling concept, DCS (Digital Code Squelch). DCS uses digital code information to open squelch on a receiver that has been programmed to accept the specific code being transmitted. Up to 100,000 different 5-digit codes are possible, allowing each station to have its own "private call" code or to respond to a "group call" or "common call" code. Program your call sign (up to 6 digits) in the ASCII code and it is automatically transmitted when the transmit key is depressed. The CD-10 stores the calling station's call sign in its memory for future reference, and it is also displayed on the L.C.D. readout. The CD-10 can store call sign data of up to 20 stations, allowing you to quickly check for calls if you have been absent from your station, and review your contacts for logging purposes. The DCS/call sign data transmission system uses mark and space frequencies within the normal speech band width (compatible w/most repeaters).

TM-201A/401A

The extremely popular TM-201A 2 meter FM (25 watts, 142.000 to 149.000 MHz) and the TM-401A 70 cm FM (10 watts, 440-450 MHz) ultra compact mobile transceivers are also available.

Specifications and prices are subject to change without notice or obligation.

KENWOOD

TS-430S

QRX. . .

EDITED BY PERRY DONHAM KW1O

Rocky Road

A LONG, HARD BATTLE is drawing to a close in **Burbank, Illinois.** In 1982 the Chicago suburb of Burbank enacted an ordinance that virtually froze ham radio in its tracks. Among other things, the ordinance: required registration of all radio antennas (with proof of insurance), suspended the issuance of amateur and CB antenna permits for one year, and declared that any interference by a transmitter to any device was unlawful, with a penalty of up to $1000 for each day of violation! After two and one half years, the city and the personal radio community have reached a settlement in the form of a Consent Decree, in which the city agreed to repeal the offensive legislation. In its place, Burbank will enact a milder form of the ordinance, one that places far fewer restrictions on what are recognized (at least in Burbank) as fundamental Constitutional rights.

India Invite

LOOKING FOR INDIA ON 75? Then **VU2CVP** and **VU2DVP** are looking for you. They can be found nightly near 3.895 MHz, listening down 100 kHz. The pair is also available for skeds and may be reached via their *Callbook* addresses.

Bird Heard

THE MYSTERIOUS SATELLITE that appeared recently in the amateur 13-cm band has been identified as not one, but two new Soviet early-warning systems. **W4HHK, WB5LUA,** and **Dick Flagg** of the Kittering Group tracked down the twin birds, which have been identified as Cosmos 1547 and Cosmos 1604. Since hams are only secondary users of this band, there's not much we can do about the problem. Bob Atkins KA1GT suggests that the satellites be used as beacons to help test and align ham equipment.

W8HXR

JERROLD SWANK W8HXR has passed away at the age of 80. Since 1919 he had frequented the amateur bands, constantly giving of himself to help others in need. His station served the victims of earthquakes and floods, and, through thousands of phone patches, the lonely bases of the Antarctic. Jerry is perhaps best known for his book, *The Magic of Ham Radio*, in which he recounted his many exploits and outlined the history of our hobby. The bands will never be quite the same.

Nice NARCs

BILL BURDEN WB1BRE of the **Nashua (NH) Area Radio Club** wrote us a nice note detailing a fundraiser recently completed by his group. Bill was one of our "Space Shuttle Special" reporters during W5LFL's historic flight. Instead of wasting his payments on frivolous things like radio equipment, he donated the cash to NARC, which used it as seed money for a charity raffle benefiting the **Shriners Boston Burn Unit.** The club donated a grand total of $1572 in 1984. Now *that* is community service.

Hello, Radio

NEVER SAY DIE goes on the air! We'll be putting W2NSD/1 on the bands every Tuesday at 2200 UTC. Look for us around 14.255 MHz and up. We're willing to chat about anything you like, but keep in mind that we can't discuss business over the air. Of course we have QSLs—thousands of them—and you can have one for the price of a contact. See you on twenty!

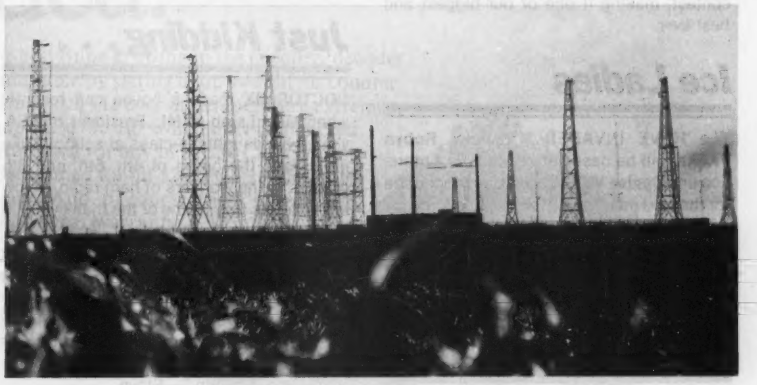
Big, BIG Gun!

RADIO NETHERLANDS fans will have a chance to talk back to their favorite shortwave broadcaster on February 16th and 17th, when **PA6FLD** will be active from Radio Netherlands' new Flevo transmitter site. Just so everyone will be sure to hear the station, the hams will be using Radio Netherlands' giant curtain array—one of the largest directional antennas in the world! Plans call for both SSB and CW operation, beginning at 0600 UTC February 16th and ending at 1800 UTC February 17th. Specific frequencies have not yet been announced, but you shouldn't have any trouble finding the station...simply tune around until your antenna begins to get warm!

Ben Akins KB1FJ (left) presents Ray Palmer a check for $1017.

CLASS Act

CHRYSLER CORPORATION has come up with a really CLASSy item. CLASS, or the **Chrysler Laser Atlas and Satellite System,** uses the government's NAVSTAR satellite network to monitor the location of your vehicle. By precisely measuring the time it takes various signals to reach your car's antenna, the system can determine your vehicle's position to within a few feet. This information is displayed as a glowing, moving



Radio Netherlands' giant Flevo transmitting site.

dot on a laser-disk-generated map. A microcomputer automatically changes maps as you move from area to area. Incredibly, the feature adds just $500 to the price of a new automobile!

Tank You

"A LITTLE DIFFERENT" is the way **Erv Carrigan KA8EKG** describes his shack (see photo). On the surface, Erv's place looks like a typical radio room, with maps and flags and modern gear. But it's not *on* the surface, and that is what's so unusual. According to Erv, "My shack is built in a cistern eight feet under ground, with eight inches of reinforced concrete overhead and 12 inches of limestone blocks on all sides, except where I made a door." Erv's ham career started when he was 71 with a Novice license and continued with a General ticket at age 73! His is certainly one of the strangest locations I've seen...can you top (or bottom) it?

Generals QSY

GENERAL-CLASS OPERATORS can now check into AMSAT nets. The frequency has been changed to 3.855 MHz, and the three nets (east coast, midwest, and west coast) still meet at 9 pm local time.

Brewers

THE HOMEBREW III JUDGES, weary from wading through the flood of excellent contest entries, have made their decision. The winner, and recipient of our $250 Grand Prize, is **Alan Smith W8CHK** for his entry, "A Something-for-Nothing Commodore 64 RTTY Interface." Look for Alan's article in a future issue of *73*. Second place, and a $100 prize, goes to **Kevin Jones KA8RCJ** for "The Five-Dollar Six-Element Delta Loop." Our three runners-up, each receiving a $50 bonus, are **Paul Bunnell KE6VK, Hugh Wells W6WTU,** and **Hank Goldman WA2OVG.** Congratulations, guys! And a big "thank-you" to all of those who entered this year's contest, making it one of our biggest and best ever.

Ice Ladies

YLs HAVE INVADED VK0-land. **Robyn VK0AK** will be based at Mawson in Antarctica and **Denise VK0YL** will be on Macquarie for the next year or so. Robyn plans to be active on all bands, using VK2DES as her QSL manager. We don't have QSL information for Denise yet; we'll pass that along as soon as it is made known.

OX3FS

73 HAS JUST LEARNED that **Finn**

Erv KA8EKG in his subterranean shack.

Steenstrup OX3FS has passed away in a tragic accident involving the giant radio dish at SRI/Greenland. Finn was instrumental in the effort to save the crippled UoSAT-2 spacecraft, using the super-sensitive SRI receiving system. By tracking the local-oscillator emissions of the bird, technicians were able to accurately plot orbital data which led to the reactivation of the satellite. Ironically, it was this antenna that Finn was working on at the time of the accident.

"01110101"

A NEW AMATEUR MODE will be offered in the very near future by **National Communications Group (NCG).** Their just-announced 220-MHz multimode rig features CW, SSB, FM, and...*digital audio!* That's right, a 25-kHz-wide digital-audio mode is included in a package that runs under $550. Delivery is expected in mid-1985, and you can look for a preview of the rig at the Dayton bash coming up in the spring.

Glass Fist?

MORSE SENDING TESTS are optional, according to the FCC. The latest set of VEC instructions allows for a Morse sending test in addition to the required receiving exam. The FCC has for many years given only a receiving test, feeling that this was adequate proof of proficiency in the code. International law requires sending *ability*, but does not stipulate an actual sending test.

Just Kidding...

DOCTOR DX made a house call recently when **Mike Lamb N7ML,** President of AEA, visited his daughter's class at school. Mike introduced the group of 4th, 5th, and 6th graders to the wonders of ham radio. Below are excerpts from some of the thank-you letters he received (verbatim).

- "Thank you for taking the time to visit us...I would like to be an amicher radio man when I grow up."—David
- "At the end of your visit I became interested in being a ham radio operator. Although it would cost a couple houndred dollars it would be fun."—Steve
- "Thanks for coming to our classroom and talking about how it works. (sorry I forgot the name of it!)"—Aaron
- "...you tawght us alot about Morris codes...I'm really interested in being a ham."—Katie
- "Thank you for coming to our classroom. Even though I missed the presentation, I wanted to see it."—Maret
- "I thank you so very, very, very, so very much. I learned very much about Hand Radio Operators. When I grow up I want to be a Hand Radio Operator."—Michelle

As you can see, the kids *really enjoy* learning about ham radio!

Pie Slicing

THE LAND MOBILE SERVICE has been awarded 41 MHz of UHF spectrum. In a recent FCC action, allocations in the 800-900-MHz range were divvied up between the Land Mobile Service, various broadcasters, satellite communication vendors, and the US Department of the Interior. It is hoped that the allocations will help ease some of the pressure from commercial concerns to take over the amateur 220-MHz band.

Spotters Spotted

TED PAUCK K8NA wrote to tell us of a DX repeater operating in southeast Michigan. K8NA/R may be found on 144.53/145.13 MHz and is intended for contest spotting and DX information. Ted thinks we should compile a list of DX repeaters in the form of a directory. OK, why not? If you have information about a DX-oriented repeater in your area, send it along to "QRX" and we'll make a mini-directory available for an SASE.

Split Decision

CALIFORNIA'S SOUTHERN TIER might be joining many western states in adopting the 20-kHz two-meter repeater band plan. With their backs to the sea and with surrounding states already implementing the plan, the **Southern California Two Meter Area Spectrum Management Association** has begun a feasibility study to determine the effect of making the switch. Such a move could force northern California repeater systems to fall in line with the rest of the Pacific Northwest states already using 20-kHz splits. Another important state, Texas, will vote on the band plan this month. How far to the east can the wave roll before hitting a brick wall?

Thanks!

DON'T FORGET to send in your news items, comments, and photographs to "QRX." This month we had help from *Westlink*, the *W5YI Report*, WA6ITF, WB1BRE, *220 Notes*, *Amateur Satellite Report*, and scores of our friends who support "QRX" with their cards and letters.

A fresh idea!

Our new crop of tone equipment is the freshest thing growing in the encoder/decoder field today. All tones are instantly programmable by setting a dip switch; no counter is required. Frequency accuracy is astonishing ±.1 Hz over all temperature extremes. Multiple tone frequency operation is a snap since the dip switch may be remoted. Our TS-32 encoder/decoder may be programmed for any of the 32 CTCSS tones. The SS-32 encode only model may be programmed for all 32 CTCSS tones plus 19 burst tones, 8 touch-tones, and 5 test tones. And, of course, there's no need to mention our one day delivery and one year warranty.

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15

SS-32 $29.95, TS-32 $59.95

VIC RTTY Resource

Is your VIC-20 ready for RTTY?
Make it happen with N5ALE's foolproof software!

R. L. Hudgins N5ALE
Rt. 1, Box 1254
Kountze TX 77625

The purpose of this article is to provide all the information you will need to put your VIC-20 computer on RTTY and ASCII for very little money. The programs allow transmit and receive on RTTY and ASCII with message storage in the RTTY program and CW ID in both programs. The user-port connections are included and will work with any interface you care to use.

The introduction of the VIC-20 computer spurred a sudden growth of interest in VHF computer operation and the simple ASCII program was developed to take advantage of that. The RTTY program was developed for those who don't have enough available money to purchase the more expensive packages but still want to run RTTY.

While no standard has been set here in southeast Texas, I am hoping that I can hook enough people with the RTTY program so that some will start using 110-baud ASCII on VHF, and by general use, set ASCII as a standard for VHF. The ASCII programs take up less memory and run faster than RTTY. This makes little difference at slow speeds such as 60 wpm, but as data rates increase and we go to more automated modes of communication, it will become very important. For those of us who never see a program or device that can't be improved upon, the program description will help, I hope.

I can't claim that all parts of the program were original. The CW ID routine is modified slightly from a program produced by Kinetic Designs, 401 Monument Rd. #171, Jacksonville, Florida 32211. The RTTY program from Kinetic Designs is very

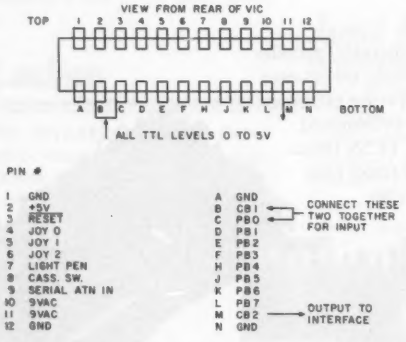

Fig. 1. This is the view of the user I/O port on the right side of the VIC as viewed from the back, with pin descriptions.

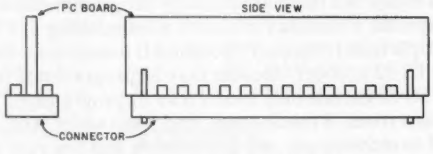

Fig. 2. This is the view of the connector after the PC board is epoxied in between the two rows of pins. The two long objects at either end are long #6 machine screws. These help strengthen the back board and provide good anchors for epoxying. Also it may be useful to mark the top and bottom of the edge connector with a permanent marker of some kind.

good but requires an 8K memory expander. I highly recommend their software if you have the extra memory. It has quite a few extra features.

The RTTY program follows a fairly simple outline. Line numbers 50 through 112 are for variable setup. The open statement opens the RS-232 port which is built into the VIC. It also sets the speed and handshaking for the program. In line 110, the dimension statement sets the heart of the program, the array that holds the data for converting Baudot to ASCII and back again for transmit.

The actual receive routine starts on line 130 where the get # statement brings in the Baudot code, and if there is nothing there, it goes to line 200 to check for keyboard input. Lines 140 through 142 convert the Baudot code to a number and check for control characters for letters and figures. If they are detected, a variable is set and the program loops back to get the next character.

Line 150 is the Baudot-to-ASCII conversion where the actual value to be printed on the screen is looked up in the data tables. If the program is in the letters mode and an A is received, the number returned in variable RB is 3, which is the Baudot code for A. This is then added to the value in variable SH, which for letters is 1, to give you the fourth character in data line 1000. This is the number 65, which is the ASCII code for A. Lines 160 to 550 print the value on the screen and check for transmit, speed change, and CW ID control characters.

The transmit routine starts on line 700. Lines 700 through 710 set the heading and speed and check for control and out-of-range characters. Lines 715 and 718 check to see whether the character is a letter or figure, transmit the proper Baudot control character, and set the variable F to the proper value for the data encoding through line 719. Line 719 is the reverse process of the receive function in line 150. Line 720 is included so that after 72 characters are transmitted, a line feed and carriage return are transmitted so that the program will be compatible with the older mechanical Teletypes®. Line number 750 actually sends the Baudot character.

I had thought about stopping with the simple transmit and receive sections, but I decided that message and CW ID capabilities were really needed. The messages start at line 805. I put a CQ call in the first buffer, which is started by pressing the F1 key. You can substitute any message you want there and then continue it in line 806. Just be sure to keep the message between the quotes and end the line with GOTO 820. Otherwise, your message will go off by itself and never come back. The second message buffer is called with the F2 key and starts on line 810. It is handled the same as the first. Don't forget the GOTO on 812.

The call in line number 2230 is "DE N5ALE." To change this, replace the code between the quotes with "DE your call" in Morse code, using the period and the minus keys. Also, all spaces are transmitted, so be sure to provide a space between DE and the call.

As you read the program, you will see some odd symbols. The symbol in line 116 is the shifted clear/home key. The heart in line 500 is the shifted S; the symbol in line 530 is the shifted W; the symbol in line 706 is a shifted I; the symbol in line 707 is a shifted R. To call the transmit routine, press the shift S. The CW ID is shift I and the messages are called with the F1 and F2 keys. The CW ID and messages are only reached from the transmit routine, and after the CW ID, the program returns to the receive routine. The speed-change section is called with shift W from both transmit and receive.

When typing this program, it will be necessary to abbreviate all commands and use other techniques to save memory. These standard abbreviations are found in the personal computing book that comes with the VIC. These are on page

```
2 PRINT"□ R.L.HUDGINS" :FORJ=1TO1000:NEXTJ
4 PRINT"■■■■■■■■■■■■■■■■  ASCII" :FORJ=1TO500:NEXTJ:PRINT:PRINT
10 REM ASCII 110BAUD
21 PRINT"BAUD 110=131,300=134"
22 INPUT F%
30 REM 224=SPACEPARITY,FULL DUPLEX
100 OPEN2,2,3,CHR$ (F%)+CHR$(224)
110 GET#2,A$
200 REM MAINLOOP
210 GET$
211 IFB$=CHR$(133)THENGOSUB2200
225 IFB$<>""THENPRINT#2,B$;
230 GET#2,C$
240  PRINTB$;C$;
250 SR=ST:IFSR=0THEN200
370 CLOSE2:END
2200 REM CW ID
2202 XM=37148:N=192:F=224:XX=3:PRINT""
2203 FORI=1TO10:MM=PEEK(37150):NEXTI
2204 IFMM>146THENPRINT"STAND BY...":GOTO2203
2206 PRINT"CW ID..."
2208 FORI=1TOTH:NEXTI
2210 ID$="-. .    ":REM*DE
2220 GOSUB2300
2225 .
2230 ID$="-. ..... .- .-.. . ":REMCALL (N5ALE)
2235 .
2240 GOSUB2300
2265 POKEXM,238:PRINT"OK"
2270 GOTO110:REM RETURN
2300 REM*SEND
2310 FORI=1TOLEN(ID$)
2320 X$=MID$(ID$,I,1)
2330 IFX$="."THENMM=10
2340 IFX$="-"THENMM=30
2350 IFX$=" "THENFORJ=1TO30*XX:NEXTJ:GOTO2370
2360 POKEXM,N:FORJ=1TOMM*XX:NEXTJ:POKEXM,F
2370 FORJ=1TO10*XX:NEXTJ
2380 NEXTI:RETURN
```

ASCII program listing.

```
50 PRINT"□    RTTY "
60 PRINT"    N5ALE"
70 PRINT"  R.L.HUDGINS"
100 OPEN2,2,3,CHR$(102)+CHR$(16):GET#2,RC$
110 DIMAA%(64),BA%(59):FORI=1TO64:READAA%(I):NEXTI:FORI=1TO59:READBA%(I):NEXTI:S
H=1:F=0
112 H=666:L=665:POKEL,211:POKEH,87:WP$="60"
116 CL$="□                    ":NA=0:S=1:AS=0
117 PRINT"□"CL$"RCV"WP$"WPM"
130 GET#2,RC$:IFRC$=""THEN200
140 RB=ASC(RC$)
141 IFRB=27THENSH=33:GOTO130
142 IFRB=31THENSH=1:GOTO130
150 RD%=AA%(RB+SH):RD$=CHR$(RD%):IFRD$=CHR$(13)THEN130
160 PRINTRD$;:GOTO130
200 GETK$:IFK$=""THEN130
500 IFK$="●"THEN700
530 IFK$="○"THENGOSUB2500:GOTO117
550 GOTO130
700 PRINTCL$"XMIT"WP$"WPM":F=1
704 GETK$:IFK$>CHR$(132)ANDK$<CHR$(135)THENGOSUB800
705 IFK$=CHR$(13)THENGOSUB760
706 IFK$="▌"THENGOSUB2202
707 IFK$="▐"THEN117
708 IFK$="○"THENGOSUB2500:GOTO700
710 IFK$<" "ORK$>"Z"THENGOTO704
715 IFK$<"A"THENF=31:IFS=1THEN PRINT#2,CHR$(27);:S=0:GOTO719
718 IFK$="A"ORK$>"A"THENF=31:IFS=0THENPRINT#2,CHR$(31);:S=1
719 D=ASC(K$):D=D-F:O=BA%(D):PRINTK$;
720 AS=AS+1:IFAS=72THENAS=0:GOSUB760
750 PRINT#2,CHR$(ABS(O));:IFMM=0THENGOTO704
755 RETURN
760 PRINT#2,CHR$(2);:PRINT#2,CHR$(8);:PRINTCHR$(13);:AS=0:RETURN
800 MM=1:Z=ASC(K$)-132:ONZGOTO805,810
805 MB$="CQ CQ CQ CQ DE N5ALE N5ALE CQ CQ "
806 MB$=MB$+"                ":GOTO820
810 MB$="RYRYRYRYRYRYRYRYRYRYRYRYRYRYRY"
812 MB$=MB$+"TEST ":GOTO820
820 FORG=1TOLEN(MB$):K$=MID$(MB$,G,1):GOSUB705:NEXTG
860 MM=0:RETURN
1000 DATA0,69,0,65,32,83,73,85,0,68,82,74,78,70,67,75,84,90,76,87,72,89
1010 DATA00,81,79,66,71,0,77,88,86,0,0,51,0,45,32,0,56,55,0,36,52,0,44,33
1020 DATA58,0,40,53,34,41,50,35,54,46,49,57,63,38,0,39,47,59,0
1500 DATA4,13,17,20,9,0,26,11,15,18,0,0,12,3,28,29,22,23,19,1,10,16,21,7,6
1510 DATA24,14,30,0,0,0,0,25,0,3,25,14,9,1,13,26,20,6,11,15,18,28,12
1520 DATA24,22,23,10,5,16,7,30,19,29,21,17
2202 XM=37148:N=192:FF=224:XX=2
2203 FORI=1TO10:MM=PEEK(37150):NEXTI
2204 IFMM>146THENPRINT"STAND BY...":FORI=1TO2000:NEXTI:GOTO2203
2206 PRINT"CW ID..."
2230 ID$="-. .    -. ..... .- .-.. . "
2240 GOSUB2310
2265 POKEXM,238
2270 GOTO117
2310 FORI=1TOLEN(ID$)
2320 X$=MID$(ID$,I,1)
2330 IFX$="."THENMM=10
2340 IFX$="-"THENMM=30
2350 IFX$=" "THENFORJ=1TO30*XX:NEXTJ:GOTO2370
2360 POKEXM,N:FORJ=1TOMM*XX:NEXTJ:POKEXM,FF
2370 FORJ=1TO10*XX:NEXTJ
2380 NEXTI:RETURN
2500 PRINTCL$"60,66,75,100 WPM":INPUTWP$
2505 IFWP$="60"THENPOKEL,211:POKEH,87:RETURN
2510 IFWP$="66"THENPOKEL,236:POKEH,79:RETURN
2520 IFWP$="75"THENPOKEL,67:POKEH,70:RETURN
2530 IFWP$="100"THENPOKEL,72:POKEH,53:RETURN
2540 GOTO2500
```

RTTY program listing.

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133. Another thing that may be done to save memory is to put no spaces between variables and other characters, even between the line number and the statement. This will not affect the listing, which will print the whole command on the screen, but will save some memory.

The program will convert to the Pet or CBM computer very easily. The only things that will present any trouble are the POKEs and PEEKs. I will try to detail all of them to make it easier. The first POKEs are in line 112. These are 665 and 666, which are for baud control in the RS-232 port. The next is a PEEK in the CW ID routine on line 2203. This is 37150, which is the interrupt register that is checked to see if all characters have been sent from the RS-232 transmit buffer. The value of XM is set to 37148 in 2202 and POKEd in 2265 and 2360. This address is for the peripheral-control register. The value POKEd in the peripheral-control register determines which bit is turned on and turned off. This is CB2, which is the output line for the RS-232 port.

The ASCII program is a very simple version of the RTTY program with only the CW ID as an extra feature. The speeds are 110 and 300 baud and are selected when the program is run. Type in either 163 or 166 and hit the return key. If you desire to send graphics, the values in line 21 will have to be changed so that eight bits, not seven, are transmitted. This can be done by changing 163 to 131 and 166 to 134. Remember, though, that this will work only between two VICs since the graphics symbols and their ASCII codes are not standard between computers. I doubt if the other computers will make much sense out of what comes from your end unless you stick to the seven-bit standard.

Both programs have room left in them for added features. The RTTY program has about 500 bytes of memory left after running. If you check the free memory before running, it will appear to have almost 1500 bytes left, but this is misleading because the open statement grabs 500 bytes and the dimension statement grabs another 500 bytes. The ASCII program has even more room to add features if you desire.

The connections for the interface are detailed in Fig. 1, but I will go over them for clarity. The input to the VIC-20 should be on pins C and B of the user I/O port; that is, C and B should be wired together on the connector and then connected to the TTL output of the interface. Pin A is ground and should be brought out to the interface. Pin M is the data line out of the VIC to the interface. That's all that is needed to connect the VIC to the interface. Be sure to observe the proper orientation of the connector when plugging into the computer. Otherwise, the fuse will blow inside the VIC and your heart will stop. I used a larger connector from Radio Shack and cut it down with a hacksaw. Before using it, though, take a piece of nonconducting perfboard cut to the same length as the back of the connector. Slide it between the two rows of pins on the back of the connector (see Fig. 2) and epoxy with nonmetallic epoxy. The five-minute kind seems to be okay. Be sure not to cover the pins needed to solder for the connections. This will make it easy to plug and unplug the connector from the computer.

Sample transmission.

These programs have been running for several months now with no problems. I hope that even if you don't now have a computer, these program descriptions will make it easy for you to get on RTTY and ASCII when you do get a computer. If you have any questions or problems, write me and enclose an SASE to expedite a reply. I will try to help if any problems arise. If you don't feel like typing these programs, send five dollars for a cassette or ten dollars for a disk to cover the cost of copying and postage. The disks are formatted for DOS2.6 on a 1540 single-disk drive. Send to Richard Hudgins, Rt. 1, Box 1254, Kountze TX 77625.

I would like to thank my wife for her patience and typing skills and Hulin Smith WB5UOI for his suggestions and hours of sometimes fruitless on-air trials. I'll look for you on RTTY. There's a whole new world waiting for you there. ■

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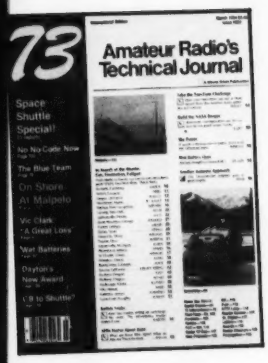

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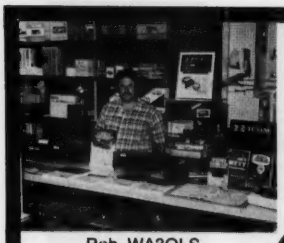

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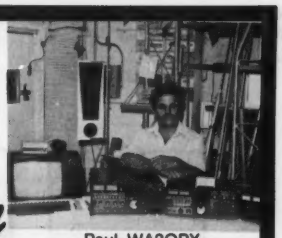

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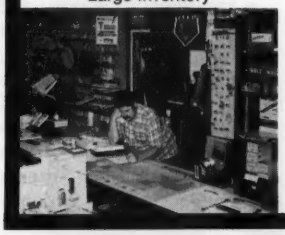

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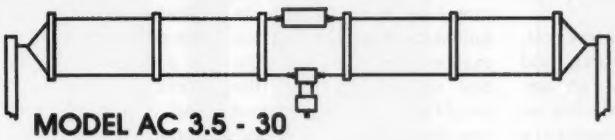

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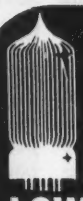

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Design

The amplifier uses a Motorola Semiconductor MRF-648 rf power transistor characterized as a 60-Watt device (power output) at 470 MHz. This power level is reached, typically, with an input of 19 Watts and a 12.5-volt collector supply voltage. Power gain is slightly higher at 13.6 volts.

Design of the amplifier began with an examination of the MRF-648 test circuit in the *Motorola R.F. Data Manual*. This circuit closely resembles the designs of several commercial units and was considered a pretty safe way to do the job. Unfortunately, it uses rather expensive and hard-to-get capacitors and has four tuning adjustments.

In the interest of low cost, ease of construction, and simple adjustment, an amplifier was designed using an approach which features a single input- and a single output-tuning adjustment and a minimum number of fixed capacitors. Low-power linearity is improved by a simple bias circuit which stabilizes against thermal runaway and idles the amplifier at 150 mA collector current.

The MRF-648, at a power output of 60 Watts and a collector supply voltage of 12.5 volts, has a series-equivalent input impedance of 0.82 + j3.3 Ohms and requires a series-equivalent load impedance of 1.07 + j2.7 Ohms (this is the conjugate of the load impedance into which the device operates). So input and output matching networks are required to perform a transformation from a 50-Ohm resistive source and load (the amplifier's input and output impedance) to these impedances.

One way of doing this is to use quarter-wave transmission lines with variable capacitors in series to cancel the inductive components of the input and output impedances. This requires input and output transmission-line characteristic impedances in the six-to-seven-Ohm region. These lines are too wide to fit the base and collector tabs of the transistor without removing material to avoid shorts and also results in high currents in the variable capacitors. A better scheme is to represent the input and output impedances by their parallel-equivalent values, then cancel the reactances with an appropriate parallel variable capacitor. Line widths fit the transistors nicely, capacitor currents are reduced, and layout is considerably simplified.

The input circuit consists of a quarter-wave transmission-line transformer which transforms the 50-Ohm input to match the low (.81-Ohm series-equivalent) value of the real part of the transistor input impedance. The parallel equivalent of the input resistance is 13.9 Ohms, so a transmission line Z_o of about 26 Ohms is needed, and a parallel capacity of about 100 pF cancels the equivalent parallel inductive reactance of the transistor input impedance. A similar scheme in the output calls for a shunt-tuning capacitor of about 120 pF and a quarter-wave transmission line of 19 Ohms. The dimensions, using glass-epoxy board, are reasonable (3.4-inch length for the input line and output lines). Dielectric losses are small at the low impedances involved and no attempt was made to use more expensive, hard-to-get materials.

The input- and output-tuning capacitors are garden

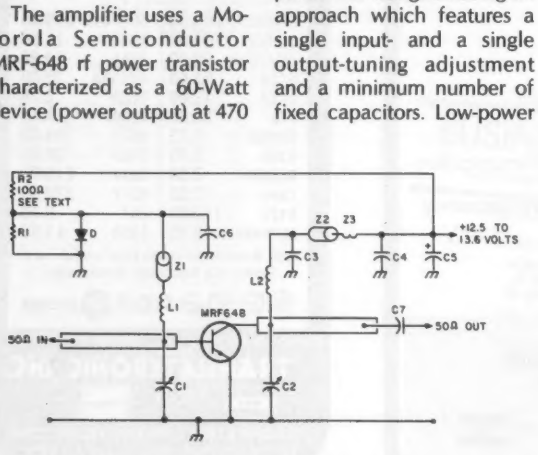

Fig. 1. Schematic.

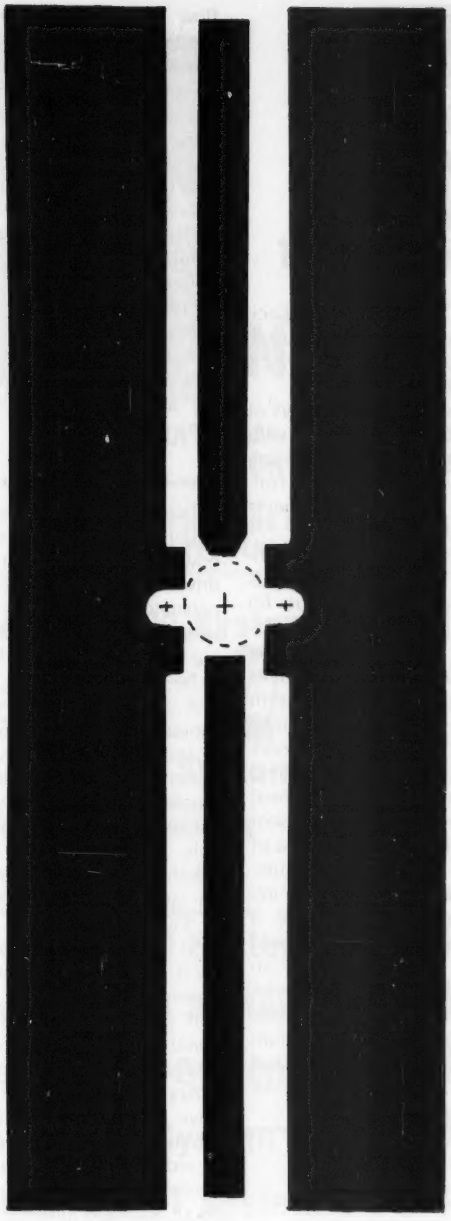

Fig. 2. PC-board pattern.

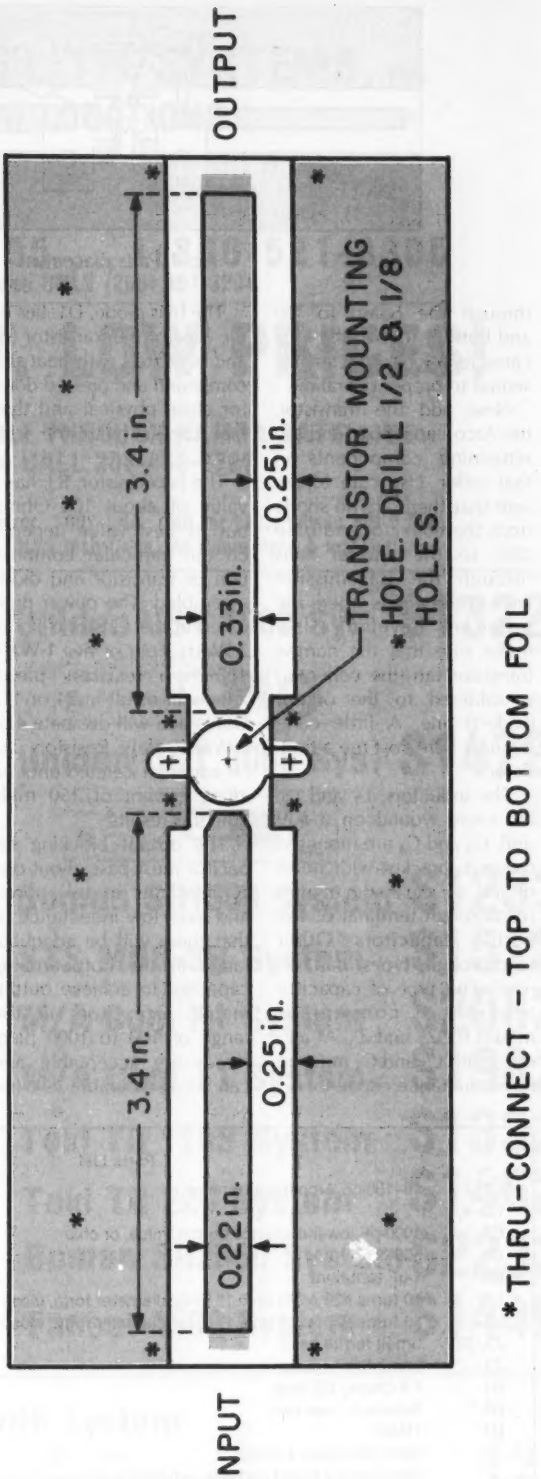

Fig. 3. Board dimensions.

variety Arco mica compression trimmers which handle the required current without any problem.

Construction

Since the board layout consists of a few straight lines, I used tape as a resist and cut and peeled the areas to be etched.

Next, the body of the MRF-648 must be recessed into the board to make connection to the PC board. A center mark for drilling a half-inch hole should be placed midway between the inner ends of the input and output transmission lines and on the transmission line center lines. Next, 1/8" hole centers, 0.73" apart, are drilled above and below the center of the half-inch hole and the board webs are filed away to allow the transistor to pass through the board. The top and bottom ground foils are connected together by soldering #18 bare copper wire or brass rivets

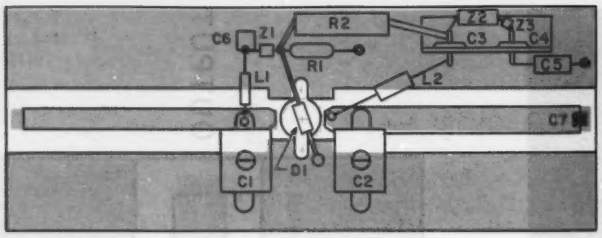

Fig. 4. Parts placement.

through the board to top and bottom foils at the indicated locations. They are essential to proper operation.

Now add the transistor, the Arco capacitors, and the remaining components in that order. Use care to ensure that there are no shorts from the collector and base tabs to the emitter tabs through the transmission lines at the points where the lines are beveled. Also, make sure that the narrow transistor tab (the collector) is soldered to the output (widest) line. A little carelessness here cost me a transistor.

The inductors, L_1 and L_2, are close wound on a #39 drill; C_3 and C_4 are mounted on an L bracket with holes drilled to clear the center feedthrough terminal of the button capacitors. Other feedthrough types can be used. This type of capacitor provides a convenient mount for Z_2 and Z_3. At any rate, both C_2 and C_3 must be low-inductance capacitors.

The bias diode, D1, lies on the face of the transistor top and is coated with heat-sink compound and pressed down for close physical and thermal contact with the transistor.

The bias resistor, R_2, has a value of about 100 Ohms, but its best value depends on the particular combination of transistor and diode assembled. The power dissipated in the resistor is about 2 Watts. Four or five 1-Watt, 470-Ohm resistors paralleled will result in 94 or 117 Ohms and will dissipate 4 to 5 Watts safely. Resistors can be added or deleted until an idling current of 150 milliamperes results.

The output blocking capacitor must pass about one Ampere rms at full power and have low inductance so that there will be adequate range in the output-tuning capacitor to achieve output match. Capacitors in the range of 100 to 1000 picofarads are acceptable and can be a solderable disc (no leads) or chip (ATC) capacitor. If a mica trimmer is used, keep leads short and watch out for heating.

I used BNC connectors at the input and output with brass shim stock mounts soldered to the lower foil. (Note the through-connects at input and output.)

Heat-sinking for the amplifier is a matter of serious concern since about 60 Watts of heat must be disposed of without causing the transistor to exceed its short-term and long-term upper temperature limits. First, choose a black anodized (or black air-drying-enamel sprayed finish) heat sink; it will require about one-fifth the surface area of bright (polished) aluminum. Surface area is of prime importance so try to find a finned sink. The fins should be on one surface only so that the board and transistor can mount on a flat unobstructed side. The aluminum thickness is important and should be at least 1/8". Air flow along the fin grooves should be ensured. The sink I used is 1/4" thick at the transistor, has fin grooves along the long (9") dimension, and is 6" wide. The grooves (fins) are 2" deep. Don't be afraid to use an oversize sink. If you must go undersize, use forced air.

Filled heat-sink compound provides the best thermal conductivity between the transistor and sink, but make sure air bubbles are excluded by pressing and rotating the transistor as it is mounted.

Parts List

C1–2	16–150-pF Arco mica trimmer	CS #424
C3–4, C7	1000-pF low-inductance button, mica, or chip	KCS #21CC510
C6	500-pF chip	KCS #21CR650
C5	1-uF tantalum	
L1	10 turns #26 AWG on 0.1" inner diameter form, close wound	
L2	10 turns #20 AWG on 0.1" inner diameter form, close wound	
Z1, Z2	Small ferrite bead	KCS #FB43-226 DP
Z3	Large ferrite bead	KCS #FB43-287 DP
R1	7.5 Ohms, 1/2 Watt	
R2	Selected—see text	
D1	1N4001	
	MRF-648 power transistor.	R.F. Parts Co.
	Glass-epoxy board material—dielectric approximately .050" thick—double-clad copper	

CS—Circuit Specialists, PO Box 3047, Scottsdale AZ 85257
KCS Electronics Corp., 1043 N. Stadem Dr., Tempe AZ 85281
R.F. Parts Co., 1320 Grand, San Marcos CA 92069

Tune-Up and Operation

Before connecting the amplifier to a source of drive power, make sure that the driver has a series blocking capacitor. In the rare cases where there is no dc blocking capacitor, one will have to be added.

A 50-Ohm dummy load should be connected to the output connector. Most dummy loads available to amateurs are not purely resistive and some are not usable at 70 cm. The new Heath "Cantenna" advertises an swr of less than 1.5:1 at 450 MHz. A lightly coupled diode probe can be used to indicate relative power.

If you have a VHF directional coupler, use it for a relative power indicator.

Apply about 10 Watts of drive and peak the input trimmer for maximum power, reduce drive to cut the indicated power reading by about half, and tune the output trimmer for maximum. Further reduce the drive and re-peak the input. Touch up the output at full drive and you are ready to connect to the antenna. For maximum stability and safest operation of this amplifier, the antenna and feedline combination should present a load close to 50 Ohms resistive, which means an swr close to 1. Make antenna adjustments at reduced power and operate with an swr of less than 1.5. ■

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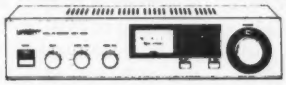
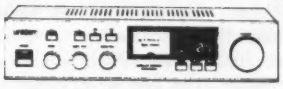


Uniden UST 3000 Sys. $1472



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CB to Six

Why stop at 10 meters? KB5LF's Hy-Gain conversion will take you to VHF just as easily.

Several years of converting CB sets to ten meters makes one really appreciate the built-in ability of these little rigs. Those of us who are operating them now on single sideband or FM can attest to their stability, sensitivity, and clean output. It was for these reasons I began experimenting with the possibility of converting a CB to six meters. Since I had several Hy-Gain boards on hand, that's what I selected for conversion.

My basic criteria for a successful conversion were:

a) Simplicity—The conversion should be no more difficult than to ten meters.

b) Quality—The receiver should maintain its original sensitivity/selectivity; additionally, the transmitter output should be very clean!

c) Cost—I firmly believe a conversion loses its appeal when the price is too high or when exotic parts are used and can't be easily obtained.

After the conversion was completed, I felt that the criteria had been met. The little rig operates beautifully on six meters!

My objectives in writing this article include:

a) Offering specific information to convert the Hy-Gain board to six meters.

b) Giving enough general information to allow you to begin converting the CB of your choice.

c) Increasing the use of our six-meter band.

I must tell you in the beginning that I will not describe the hookups required to make the board operate nor specifically detail FMing the rig. I'll just refer you now to the many excellent *73* articles that have detailed this part of the conversion. Your main obstacle to six-meter operation is moving the radio from eleven meters AM to six meters AM. Sidebanders, take note—I'll not forget you, either. Your conversion may also be surprisingly simple.

Examine the basic block diagram of Fig. 1. To move any CB in frequency, the master frequency source (vco, crystal synthesizer) *must* be made to operate at a new frequency. We know from our ten-meter conversions that we must increase the frequency. The question is, how much? Keep in mind that, generally speaking, the master frequency source (vco, synthesizer) of most CBs does not change frequency between transmit and receive. If we can determine the correct vco frequency to inject into the first receive mixer, we will also have found that this same frequency is used for transmit.

Refer again to Fig. 1. Three incoming frequencies are shown. The first is an incoming original CB frequency; the second is a 10-meter FM frequency; the third is a new frequency in the six-meter band. Note also that these frequencies are in the center of their respective bands. The frequencies generated by our master frequency source that mixes with the incoming signals is also shown. Let's examine how the master frequency is determined.

If we examine Fig. 1, we see that a 27.185-MHz signal is amplified by one or more rf stages before it is mixed with the master frequency. During the mixing process, the first i-f frequency is selected. In our case, the first i-f frequency is 10.695 MHz. In almost every case, the receive-mixer circuitry selects the *difference* frequency. Our equation:

For 11-meter operation—master frequency = incoming frequency + first i-f frequency = 27.185 MHz + 10.695 MHz = 37.880 MHz.

For 10-meter operation—master frequency = 29,600 MHz + 10.695 MHz = 40.295 MHz.

For 6-meter operation—master frequency = 52.525 MHz + 10.695 MHz = 63.220 MHz.

The equation in a different form: master frequency − incoming frequency = first i-f frequency.

If your particular radio

uses a different i-f frequency (10.7 MHz, 7.8 MHz, etc.), change the i-f frequency in the formula and crank out the new master frequency. During the change to 10 FM, the Hy-Gain's vco frequency was increased about 2.5 MHz, an increase of approximately 6%. This change is not excessive. There is enough adjustment range in the circuitry to handle this increase in frequency. Examining the percent change from 11 to 6 meters, we find that increasing the vco frequency from 37.880 MHz to 63.220 MHz involves increasing the frequency approximately 25 MHz. The percent change in frequency is approximately 67%. This is asking too much of the circuitry. Without major modification to the vco circuitry, it will not operate in the 60-MHz region.

Any time two frequencies are injected into a mixer, many different frequencies are produced in the output. Of special importance are the sum and the difference frequencies. The tuned portion of the mixer's output will determine which of these two frequencies is emphasized. As an example, using Fig. 1, 27.185 MHz and 37.880 MHz are injected into the first mixer. The sum of these two frequencies is 65.065 MHz. The difference is 10.695 MHz, the frequency of interest. In our case, the mixer selects the difference frequency. The reader may verify the frequencies used for 10-meter operation. Note that in both 10- and 11-meter operation, the master frequency is higher than the incoming frequency; hence the term *high-side injection.*

There is another frequency that will mix with the 37.880-MHz signal to produce the 10.695-MHz output. In this case, a 48.575-MHz signal mixed with the 37.880-MHz signal will also produce the required 10.695-MHz i-f output. This frequency is called the *image frequency* and will be detected if allowed to enter the mixer. Fortunately, the designers incorporated the proper circuitry beginning at the antenna input and in the rf amplifier stage(s) to reject the image frequency. If you desire, you can determine that the image frequency on 10 meters falls within the 6-meter band.

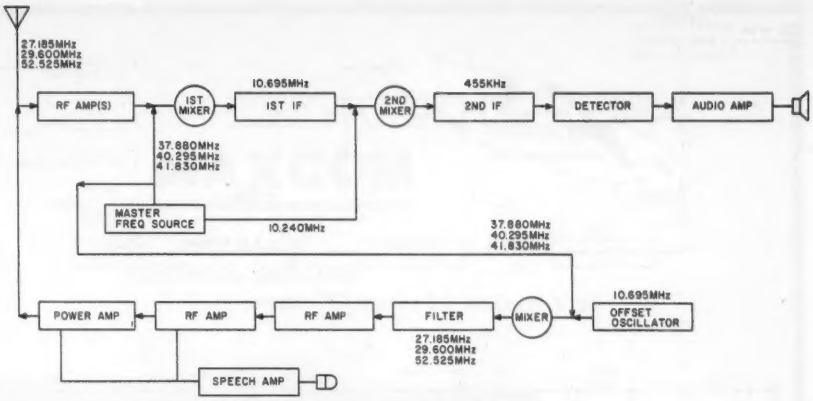

Fig. 1. Hy-Gain CB block diagram.

The problem I had to solve was on what frequency must the master frequency source operate to receive a 52.525-MHz signal and produce a 10.695-MHz output. I rejected using the 63.220-MHz frequency as described above. I elected to run the master at 41.830 MHz. Again, the difference frequency (52.525 MHz − 41.830 MHz) gives us the required output from the mixer. This mixing scheme is called *low-side injection* because the frequency of the master is lower than the incoming frequency. Using 41.830 MHz as the master frequency will allow the receiver to also detect a 31.135-MHz signal (the image frequency) if our tuned circuitry at the input will allow it to pass. We will cure any image frequency interference in this conversion.

The modification to 6 meters of the Hy-Gain vco is exactly like that required for 10-meter operation (refer to Fig. 2). Only the 11.8066-MHz crystal need be changed and the vco retuned to operate properly in the 42-MHz range. I'll briefly describe its operation and then recommend a replacement for the original crystal.

The 10.240-MHz oscillator is fed into pin 3 of the PLL02A chip. It is internally divided by 1024 to give us a reference frequency of 10 kHz. This means that our channel spacing will also be 10 kHz. Notice also that the 10.240-MHz signal is sent to the receiver section and mixed with the 10.695-MHz i-f, resulting in a second i-f frequency of 455 kHz (10.695 − 10.240 = 455 kHz).

The vco frequency of 37.660 MHz (CB channel 1) is fed to both the receiver and transmitter sections of the radio. Since we are dealing with a PLL circuit, this frequency must be fed back to the PLL02A chip and compared with the reference frequency (10 kHz) to see if any change in frequency is needed. Since the PLL02A has an upper limit (at pin 2) of approximately 3 MHz, some method of mixing the signal down to less than 3 MHz is needed. This is the reason why the 11.8066-MHz oscillator/tripler is in the circuit.

In Fig. 2 we see the 11.8066-MHz frequency being tripled to 35.4198 MHz. The tripling occurs within the circuitry associated with Q105. This frequency is mixed with the 37.660-MHz signal from the vco, and the difference frequency of 2.24 MHz is selected by the use of the low-pass filter (C108, L101, etc.). A mixer buffer (Q103) follows to ensure that the PLL02A does not load the circuitry and gives additional gain to the 2.24-MHz signal.

Assuming the vco is operating exactly on 37.660 MHz, a signal of 2.24 MHz will appear on pin 2 of the PLL02A. If the programming pins (7 through 15) on the PLL02A are set to divide by 224, a 10-kHz signal (2.24 MHz ÷ 224 = .010 MHz) will be generated. This is exactly the same frequency as the reference. The system is said to be "phase-locked." If the vco tries to change frequency or programming to the PLL02A changes, the frequencies generated internal to pins 2 and 3 will no longer be identical. The PLL02A senses this and changes its output voltage across the varactor diode (D101) to steer the vco to a condition where again both signals internal to pins 2 and 3 are 10 kHz. For you that experiment, I have found that by changing crystals and retuning the vco coil (T101), I could lock the loop from about 28 to 48 MHz. Not bad for this little circuit!

I wanted the mid-band frequency to be 52.525 MHz, one of the simplex calling frequencies for 6 meters. I knew the vco would probably be capable of maintaining lock over a

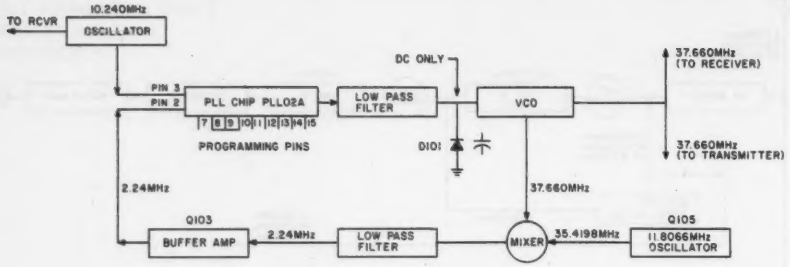

Fig. 2. Hy-Gain PLL circuit (CB channel 1).

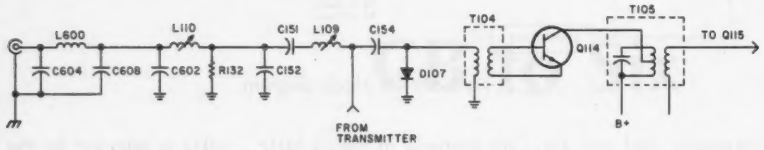

Fig. 3. Hy-Gain receiver front end.

540-kHz range. Therefore, I subtracted 270 kHz from 52.525 MHz to give a channel 1 frequency of 52.255 MHz (PLL02A set to divide by 224). The high end frequency would be at least 52.795 MHz.

If channel 1 was to be 52.255 MHz, my only problem was to decide what crystal frequency was necessary such that when it is first tripled and then subtracted from the vco frequency, the difference would be 2.24 MHz. Using our low-side-injection scheme, 52.255 MHz minus the vco frequency should equal the 10.695 i-f frequency. With scratch paper handy, a quick calculation gives us a channel one vco frequency of 41.560 MHz. If we now subtract 2.24 MHz from 41.560 MHz, we will have the oscillator frequency in tripled form. This subtraction yields 39.320 MHz. Dividing this by 3 yields the correct oscillator frequency of 13.1066 MHz. If you use another division scheme or elect to cover a different portion of the band, all numbers must change accordingly. Any of the crystal manufacturers can supply you with the correct crystal if you specify the make/model of CB and the old/new crystal frequencies.

When the new crystal (13.1066 MHz) arrives, install it in place of the 11.8066 crystal and begin the vco alignment. Access to a frequency counter and a good oscilloscope are required for proper alignment. I won't detail the vco alignment procedure as this is covered in the *Photofact* and in many of the articles appearing in *73*. A few words of caution may prevent problems:

a) All oscillators must be on frequency.

b) On some of the boards there are two positions of the vco coil slug that will give you a 1.5-volt reading. Only one is correct. If you've selected the wrong one, the vco will not track as the channels are advanced. Other radios may exhibit this same problem.

c) Ensure that the vco does not change frequency when the transmitter is keyed.

d) Ensure that T111 is set for maximum. Much of the performance depends on it.

One last word on PLL circuits may aid those of you who will convert a different radio. If you follow the low-side-injection scheme, you will keep the vco operating near the original design frequency. This greatly simplifies the conversion!

Receiver Conversion

Once again referring to Fig. 1, it is seen that once the signal passes the first mixer, we are into the i-f frequencies. I might as well tell you now that no modifications are required beyond the input to the first mixer! In simple language, once the desired signal is into the first i-f stage, the radio couldn't tell you if the original incoming frequency were 27 MHz or the new 52-MHz signal.

Fig. 3 shows the Hy-Gain input circuitry from the antenna through the first and only rf amplifier stage (minus a few parts). If you are converting a different CB, it will probably surprise you to find your input circuitry very similar to the one shown. Disregard for now all the components from the antenna connector through L109. We will work with these later. Our concern will be with C154 and the coil which is the primary of transformer T104. A grid-dip meter will verify that this combination is resonant in the 11-meter band. There is enough tuning range in the primary coil to tune 10 meters, but not enough to tune 6 meters. Changing C154 from 27 pF to 10 pF will let this combination resonate in the 52-MHz region.

Fig. 3 also indicates a tuned-collector output which is coupled into the base of Q115, the first receive mixer. Since the capacitor is inside the can, T105 must be removed and the capacitor leads clipped. There is no need to remove the capacitor from its seat inside the can. Just be sure that the leads are trimmed so they do not touch anything. Be careful unsoldering the can or you may damage the foil trace. This is good practice as this same bit of surgery will be required a time or two in the transmitter section. Install an 18-pF capacitor across the primary terminals on the foil side of the board.

A basic tune-up can now be accomplished using the receiver alignment instructions supplied in the *Photofact*. Don't expect the receiver to be extremely sensitive, as we have not yet corrected the majority of the input circuit. You will get enough signal through to satisfy yourself that the receiver is now on 6 meters. Don't forget to use a mid-band frequency for the alignment.

The receiver conversion for a different radio will closely parallel this discussion. A few tips may save you some time and effort:

a) Performance-test the CB prior to conversion. Record signal levels. Be sure these levels exist after the conversion.

b) You will have to grid-dip the transformers to find the correct value of capacitance for resonance.

c) Examine the general specifications for the transistors in the front end of the receiver (Q114 and Q115 were questioned in this case). Hy-Gain used two transistors which have a large bandwidth (F_t) and high current gain (h_{fe}). If you will look these up in a transistor manual, you will see what I mean. Examining several CB schematics did not

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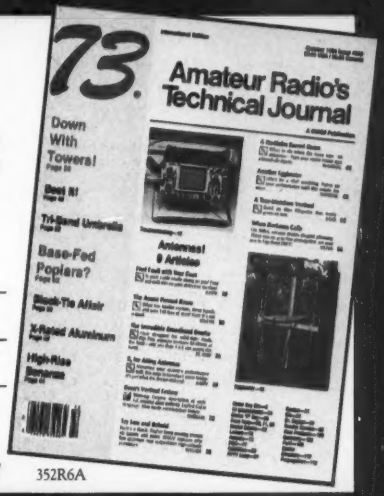

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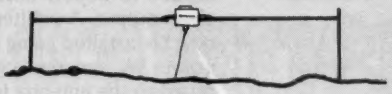

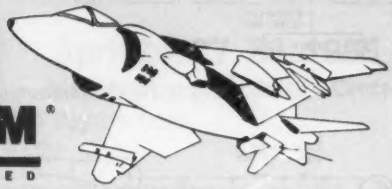

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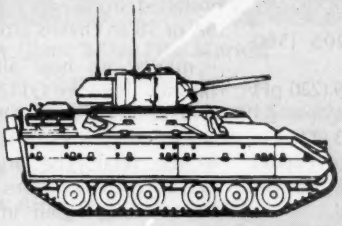

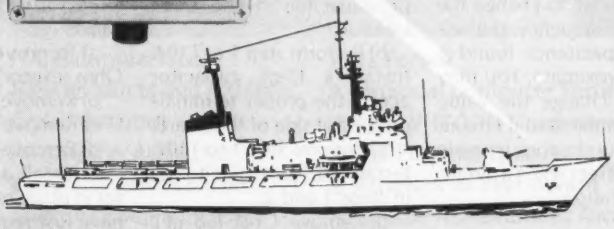

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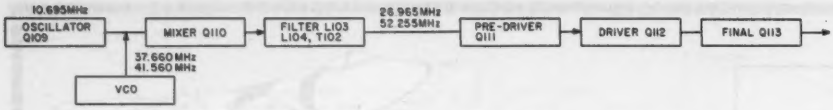

Fig. 4. Hy-Gain transmitter block diagram.

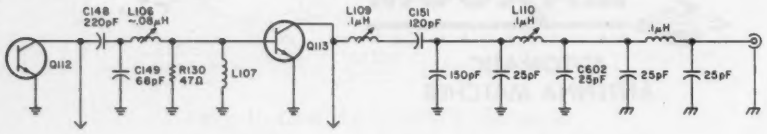

Fig. 5. New driver/final circuitry (simplified).

reveal a problem here, but it's worth checking.

d) Any time you modify the capacitor values in a tuned circuit to change the resonant frequency, the value of capacitance found is only approximate. You may need to change the value slightly in the actual circuit. This is due to the dynamic loading effect when a circuit is in operation.

Transmitter Conversion

Fig. 4 shows a block diagram of the Hy-Gain transmitter section. Also shown are the vco frequencies for both an original CB frequency and a new 6-meter frequency. Since the vco is already on frequency, all that remains is to modify the circuitry following the mixer. In the case of the CB frequency generated (26.965 MHz), the filter (L103, L104, and T102) selects the *difference* frequency (37.660 − 10.695 = 26.965 MHz). After conversion, L103, L104, and T102 will select the *sum* frequency (41.560 + 10.695 = 52.255 MHz).

Remove L103, L104, and T102 one at a time. Remember which one goes where so there is no confusion when they are reinstalled. The following steps will allow these cans to select the sum frequency:

a) Remove C124 (100 pF). Remove the small capacitor internal to L103. Reinstall L103 and solder a 33-pF capacitor across the same pins the original capacitor was across, on the bottom (foil side) of the board. Be sure to keep the capacitor leads very short. On this can you may simply place the 33-pF capacitor in the C124 location.

b) Perform step 1 to L104. Install a 15-pF capacitor across the proper terminals on the foil side of the board.

c) Perform step 1 to T102. Install a 15-pF capacitor as in steps 1 and 2.

d) Remove C141 (68 pF). Replace C141 with a 39-pF capacitor. This is required to enhance the impedance match into the base of Q111. Grid-dipping the secondary of T102 shows the secondary resonant in the 55-MHz region (with the 68-pF cap).

Next remove T103. If you glance at the schematic, you might wonder why. It would appear that since resonating capacitor C143 (100 pF) is external to the can, one might just remove it and install a 25-pF cap in its place. This will resonate the can in the 52-MHz region; however, the transformer turns ratio is now wrong. Examining the primary and secondary windings of T103 revealed a 6-turn primary and a 1-turn secondary. I could have rewound T103, but I had no wire that small. I used a ¼-inch coil form using an 8-turn primary and a 2-turn secondary. Grid-dip the primary to find the amount of capacitance needed to resonate at 52.5 MHz in the middle of the coils tuning range.

C146 (470 pF) is removed next. This enhances the impedance match at the base of Q112. Now we are ready to modify the driver and final circuitry.

Perform the following steps:

a) Remove R203 (560-Ohm resistor).

b) Remove C149 (220 pF).

c) Remove L106.

d) Remove C153 (82 pF).

e) Install a 68 pF capacitor in place of C149 that you have just removed.

f) Examine L106. We must lower its inductance by removing 2 turns. It looks factory formed, and it is. Locate the low side of the coil. Using a sharp carpet knife or similar instrument, you can cut the wire leg loose. The wire can then be unwound. Remove 2 turns and form a new leg for the coil. As a guide, the reactance of the coil should be 25 Ohms at 52.5 MHz.

g) Remove C151 (100 pF) and install a 220-pF cap in its place.

h) Remove L109. Remove enough turns to give 33 Ohms of reactance at 52.5 MHz. Its inductance should be .1 uH.

i) Remove R132 (47k Ohms) and C152. Replace C152 with a 150-pF cap. Replace R132 with a 22-pF cap.

j) Remove L110. Remove 2 turns. It should now have .1 uH inductance. Reinstall L110.

k) Remove C602 on the foil side of the board (if installed). It's attached between board ground and the antenna side of L110. Replace it with a 25-pF cap.

l) Additional filtering is needed to doubly ensure a clean output. A pi-filter will now be installed going from point 5A on the circuit board to the antenna terminal. Install an airwound coil similar in size to L116 between the board's output (5A) and the center of the antenna connector. I used an extra L116 off a broken Hy-Gain board and removed all but 3 turns. If you fabricate your own coil, the inductance should still be .1 uH. Install two 25-pF caps. One should be installed from the center of the antenna connector to chassis ground. The second cap should be installed from either point 5A or 5B to chassis ground.

m) We are now almost finished. Remove Q112 and replace it with Q113. Obtain a 2SC1307 transistor to use in the final. The original Q112 (2SC1760) does not have enough gain in the 50-MHz range. If you are converting a different CB, be sure to check the performance of the transistors. After completing the above steps, your circuit should look like Fig. 5. Notice I did not show R129, L105, L116, L108, etc. These remain unchanged!

You can now perform the alignment of the transmitter using the steps listed in the *Photofact*. As other authors have said, the alignment of L103, L104, and T102 is *critical!*

By using single-pole, single-throw switches to program pins 1 through 15 of the PLL02A, you can expect at least 1-MHz band coverage. My conversion gave me about 1.1 MHz, but the recommended voltages were not followed at the edges of the band. The vco, however, remained very stable over a voltage range of .9 to 4.5 volts. Average transmitter output averaged 3 Watts across the band, and its output is very clean.

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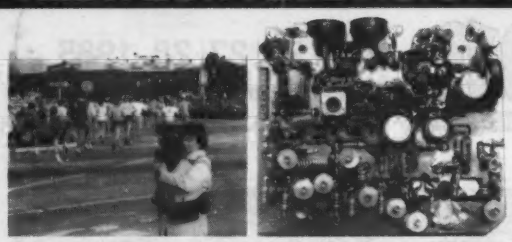

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Several improvements can be added to enhance the capability of your conversion:

a) The standard bells and whistles that have been used with the 10-meter conversions (Delta-tune, scan, frequency programming, wide audio filter, etc.).

b) Repeater offset may deserve some special mention. I have discovered that by switching transmit offset crystals, I could achieve up to 400-kHz offset without problems. If you elect to install the offset, please note that a 400-kHz split is not possible across the entire band. If you exceed the frequency limits on transmit or receive, the vco will lose lock.

I think you will find that many other used CBs operate using this same scheme. Many are practically identical! I hope this article heats up some soldering irons and sharpens a few pencils. I am sure the circuitry presented here can be improved.

For those of you interested in converting an SSB CB, I recommend staying away from those radios whose vco operates in the 19-MHz range. They can be modified, but the conversion is much more difficult. Select one that operates in the 38-MHz range and utilizes a fairly high first i-f. If you do this, you can be reasonably sure it will convert. As a bonus, the SSB generating circuitry prior to the transmit mixer will require no modification.

Completing this project confirmed my belief that 50 MHz is possible from a CB. I will be happy to answer any questions concerning this conversion if you will send an SASE. I'll send my recommendations on any other CB conversion to 6 meters if you will send me a copy of the schematic. Let's use our six-meter band! ■

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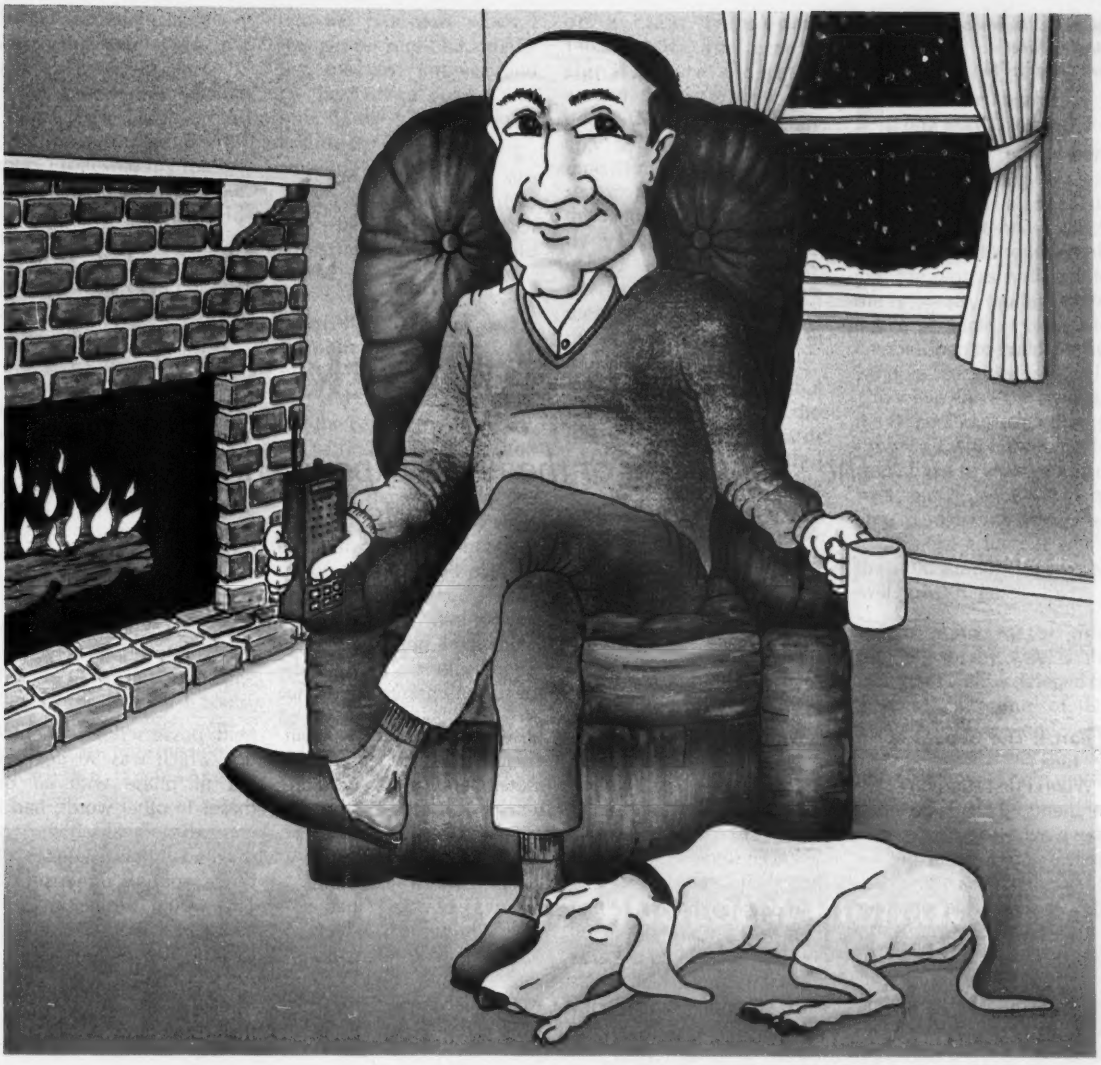

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Future Schlock

The strange tale of the KA5S experiment. Was he a genius or a madman?

Part I: The Genesis of an Idea—

When I first started my experiments, I had no idea they would lead me to such arcane conclusions. Like many others, I was just curious. And, in true amateur spirit, I was determined to breadboard my way to knowledge. I could not know I would be answering the question of the Long Delayed Echo or discovering what happened to the missing OSCARs!

I began by asking why LHCP (Left-Hand Circular Polarity) signals could not be received by an RHCP antenna. The antennas are all but identical, after all; the vertical and horizontal elements line up exactly. And so my first experiment was to find out just why the radiated wave is not received.

I started by setting up two linearly-polarized, 2-meter antennas (3-element beams), one vertical, one horizontal, 3 meters apart. From my work in the EMI lab I knew this was a good distance. It also gave 1 meter per element, which might simplify the subsequent mathematics.

With 300 milliwatts from my HT, I was able to adjust the antennas so that if I transmitted with one, no signal would be received by the other. This was exactly what theory said would happen!

In order to make sure that there was nothing untoward going on, I checked the area between the two antennas with a simple diode field-strength meter, using an untuned loop antenna .05 wavelengths in circumference. There was indeed a strong rf field being transmitted. As a further check, I ran equal lengths of coax to each antenna, feeding them both from the HT. There was still a strong signal in the space between them. Again, all was as expected.

I next added three more elements to each antenna at right angles to the ones already mounted, creating two miniature, circularly-polarized beams. I was careful to arrange the phasing so that one was right-hand polarized, while the other was left-handed. Then I repeated the above experiment. No signal was received, just as I had been informed. The surprise came when I again checked the area with my FS meter. Sending with both antennas, I discovered the signal *disappeared* midway between them! Something *really* strange was happening!

It was obvious I had discovered a hitherto unknown phenomenon: Cross-polarized antennas create a dead space between them into which radio waves disappear. The question was: Where do they go?

Part II: Investigations and Fulminations—

This line of experimentation had reached a dead end. There was no way I could pursue the missing rf energy. I did not even know where it was!

Some deep thought was in order, and I resorted to a "thought experiment." (This requires no equipment, and you can arrange antennas anywhere you like.)

In thinking over the parameters of my dilemma, I recollected that I had created a situation in which every possible field orientation had been represented. Could it be that the resultant field possessed an orientation which was 90 degrees out of phase with *all* of these? In other words, had I created a signal which was oriented at right angles to all three spatial dimensions? This would explain my inability to detect it; I was limited by the physical structures possible. And by following this logic, I could explain where the signal would show up again!

The orientation that is at a right angle to the three spatial dimensions has been called the "fourth dimension." It is also known as TIME. The signals had been translated to a different time! If I arranged to measure field strength when the rf arrived, I would be able to confirm this. But I still faced a problem. Did the signals arrive before or after I sent them, and how much time separated the transmission and the reception?

Resolving this question turned out to be easier than I had expected. It was necessary only to set up the field-strength meter, without transmitting, and wait for the signal. I would transmit

short (2 second) pulses every hour, and see when the signals showed up.

The idea seemed right, so I began an exhaustive (and exhausting) routine. For 57 hours I followed my routine, sending a pulse ever hour, and watching the field-strength meter the rest of the time. Because of the time involved, I did not dare take my eyes from the meter.

To stay awake, I ate half a jar of instant coffee. (I had discovered the effectiveness of this during Field Day.) By not mixing it with water, I avoided having to relieve myself. I left three bowls of cat food out, warned my son not to disturb me for three days, and commenced.

Success seemed mine very early in the experiment. Signals were appearing even though I was not transmitting. Unfortunately, I could not be sure that they were a result of my transmissions. I stuck with it. It was 42 hours into the procedure when I was almost sure I had identified the time interval, and by the 55-hour point I was sure. At the 57-hour point, I fell off the chair.

It was necessary to suspend investigations for two days while I slept. A thorough statistical analysis could follow.

Part III: Click, click, buzz, whirr—Eureka!

With the data in hand, it became necessary to break out the calculator. I was trying to find some correlation between my transmitted signals and the ones I had received. I had three sets of data: the time and frequency of the received signals, and the transmitted signal time. A scanner had provided me with the frequency, while the FS meter made sure it was strong enough to be *my* signal.

I had 27 strong, received signals. I had been sending on a clear frequency, 146.505 MHz. The received signals were clustered around 146.520 MHz. No doubt they had gained energy by being translated in time. (I made a note to myself to remember to patent this kind of linear translator.) By analysis, I found the received signals were clustered around 2, 3, and 7 minutes before and after my pulsed transmissions, and at multiples of these intervals.

The frequency distribution showed a 3-Sigma distribution skewed upwards from my transmitter, but was well within possible changes due to time differences. Since there was a positive statistical correlation of .56 for the time intervals I mentioned, I was able to conclude that my theory was correct, and that I could look for return signals both before and after sending them. I resolved to concentrate on the latter case, since it was difficult to tell if a given signal was mine before I sent it.

Part IV: The Future (Long May It Wave)

As a result of these experiments I am working on a less cumbersome apparatus than two antennas which will allow me to send signals into the past as well as into the future. By modifying the active principle, I expect to be able soon to build a time-variable receiver as well. This will mean I can work all the DXpeditions even though I missed them before. And I won't have to wait for an answer, either, since I will be able to adjust the time mixer for the exact time at which the DX station answered (will answer) me.

The main factor now standing in my way is the fear that I will be deluged by a whole lifetime of DX QSOs all at once, and won't be able to make any of them out! Can anyone help me? ■

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There are at least two extremely important areas relating to the construction and operation of an antenna system where there has been either too little or an excess of information. I am referring to antenna ground systems and vswr, respectively. It is my intention to furnish information that will get you thinking in the right perspective so that you can attack the problem sequentially and with a knowledgeable plan of action. This, then, is an article on the fundamental facts relating to how the quarter-wave antenna system functions. All of the fundamentals and design theory were developed and used successfully by the broadcasting industry in the early 1930s; little has changed since.

To understand "antenna performance," there are a few factors one has to accept from the very outset:

(1) The performance of an antenna is an exact science and not a hit or miss proposition.

(2) Performance is designed and not experimented into the antenna system as a whole. This includes the ground system, transmission feed system, and the antenna radiator proper. The efficiency and total performance are exactly predictable even before a signal is ever sent down the line.

(3) The ham is always fighting compromises. They are tied to the environment (surroundings), geographical location, antenna height restrictions, and the placement or location of ground radials.

Much of my explanation will be related to commercial vertical antennas but will apply equally to ham applications. The vertical has been selected as the subject matter as it is easier to define ground system performance exactly and its relation to radiation impedance. Also, it provides the opportunity to touch on phase-driven arrays. Included will be references to exact design formulas for developing high-frequency beam antennas. So let's start at the very beginning and move on from there.

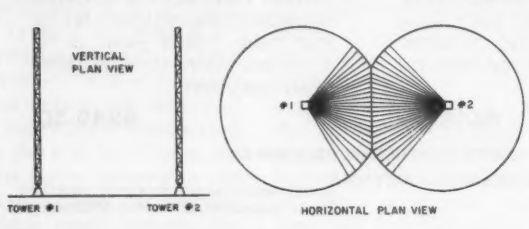

Fig. 1.

The Standard Reference Antenna

One often hears about antenna gain as related to a hypothetical antenna. What is this non-real antenna and why do we have it? As you already know, the National Bureau of Standards maintains such primary references as the volt, Ohm, inch, etc. Everything must be related and have a basic reference so that all the peoples of the world know what others are talking about, so why not a primary antenna?

This isotropic radiator has to be envisioned out in free space, radiating in all directions equally. The field pattern would be shaped like a ball, and the electromagnetic field resulting from a drive of exactly one kilowatt would have a field strength of exactly 107.6 millivolts per meter as measured at a distance of one mile. (The "per meter" indicates that the tuned field-strength instrument used to make the measurement would have a pickup antenna of exactly one meter in length.)

An isotropic antenna as portrayed cannot actually be realized since the free-space requirement is, if not improbable, very impractical. However, this hypothetical antenna has real value as an instrument for determining the figure of merit of all other antennas. The derived field strength is exacting and an antenna's efficiency can thereby be verified. The primary reference standard antenna came into common use for antenna work during WWII.

The Doublet Secondary Standard Reference

A second hypothetical antenna, one with which hams are more familiar, was derived from the spherical primary standard and is known as the doublet or dipole in free space. The secondary standard doublet reference is easier to use when determining figures of merit of ham, broadcast and consumer TV, and beam arrays here on Earth. The dipole in free space consists of a very short conductor (mathematically of infinitesimal length) having a uniform current distribution. This infinitesimal antenna is universally used in developing the radiation properties of antennas of any configuration.

Importance of the Ground Systems

The prime consideration in the design of any antenna

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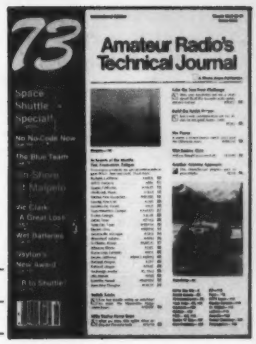

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is its ground system, but it is most significant when considering vertical systems. It doesn't make any difference whether they be commercial, ham, fixed, or mobile, the ground system determines not only the efficiency but the directivity. Without a ground system, the antenna feed has no return circuit for the drive current, there would be no counterpoise, no known stable value of radiation impedance, and no dependable direction of the signal. To say the least, the antenna design is a failure before it gets off the ground. Ironic as it seems, there are a good many hams who skim over this part of the construction because the laying out of ground radials appears extremely difficult or out of the question. As a result, one can expect only questionable results and an inefficient radiating device at best.

Construction of Radials

In order for a single vertical antenna radiator to produce an electromagnetic field of energy that is equal in all directions, the ground system will have to have a radial every three degrees. That is 120 radials of at least 1/4 wave in length. Shocking! For a commercial broadcast station this is the minimum required by FCC rules; it also is essential if one expects to control the exact shape of the field pattern. By the use of involved mathematical calculations it is possible to design an antenna system having any desired field pattern. This, however, may require 1, 2, 3, or more additional driven elements set in a straight line or rectangular configuration.

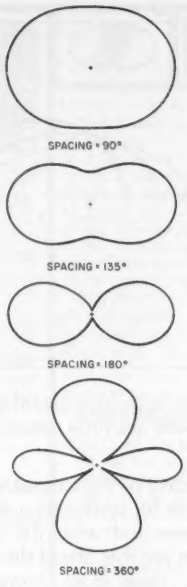

Fig. 2.

Reflections from Parasitic Objects

Commercially, the antenna site selected must be free of metal power poles, water tanks, and smoke stacks or the pattern will have a direction away from the unwanted objects. Metal power poles really can foul up the pattern beyond control. Hams, on the other hand, generally do not have this luxurious option. Fortunately, ham requirements are not this stringent, and if one is reasonably fortunate, there will be as few as three or four ground radials as a compromise. The fewer radials used, the more inefficient the radiated power and the less the directive control. We will pick up this subject again with more detail as we work into it.

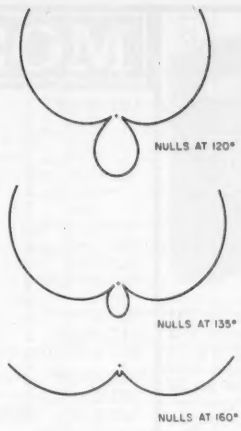

Fig. 3.

Shaping the Field Pattern

Assuming a quarter-wave vertical antenna that radiates a perfect donut-shaped pattern, how does one change the pattern shape? First, a minimum of two or three elements or towers will be required. For the most effective control, all elements should be driven.

There are at least three factors that affect the radiation pattern. (1) The electrical spacing between towers or elements, (2) the amplitude of the drive current to each element, and (3) the phase angle in degrees between the currents in each. Once the number of elements and the spacing between elements have been determined those factors become fixed, and thereafter, the only two remaining variables are the current in each element and the phase angles of these currents. By manipulating these two parameters as mathematically calculated, it is possible to achieve almost any pattern shape desired.

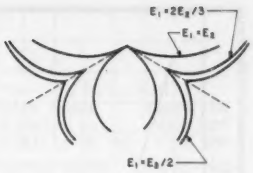

Fig. 4.

Effect of Unsymmetrically-Placed Radials

In a multi-tower system, each with its own ground system, some of the ground radials from one tower could intersect those of the adjacent elements but instead are terminated and bonded together where they meet. (Refer to the illustration of a partial ground system, Fig. 1.) The ground radial systems for each element should be the same. If they are not, some non-circular radiation from a given element or tower could result.

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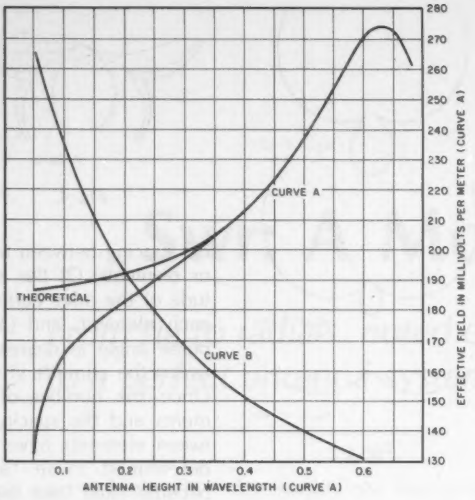

Fig. 5. Effective field at one mile for one kilowatt (curve A). Use for simple omnidirectional vertical antenna with ground system of at least 120 radials, 1/4λ.

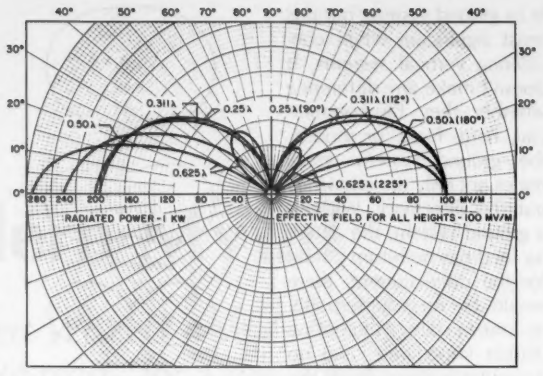

Fig. 6. Vertical radiation patterns for different heights of vertical wire antennas (sinusoidal current distribution).

If, for example, one tower has fewer radials in a given direction than another, the directivity of that tower may be impaired due to the increased ground loss on that side of the tower.

Let's examine one of the most simple systems, one of just two towers or elements. (The terms tower, element, radiator, and antenna are accepted as one and the same.) Bear with me on the concept of 120 radials as it is important. Let's assume that the towers are the same height and each has an FCC-minimum ground system of 120 radials. Additionally, each tower receives the current at the same instant. This means that there is a zero time-phase difference.

Effect of Distance Between Elements Measured in Degrees

Rather than resort to a lengthy explanation, let me refer you to Fig. 2, which has an elliptical pattern resulting from a spacing between elements of a quarter wave, or 90°. Other illustrations in Fig. 2 are for three-eighths wave, or 135°, a half wave, or 180°, and a full wave, or 360° spacing. Note the change in field pattern effected just by changing the distance between driven elements. By fixing the spacing to, say, one-quarter wavelength (90°) and varying the phase relationship of the currents in each element (but maintaining equal currents) we can obtain a wide variety of shapes.

Observe in Fig. 3 the null shift as the current phase is changed by 120°, 135°, and 160° respectively. The last illustration, Fig. 4, shows variations of the pattern when a spacing of a quarter wavelength is maintained along with a phase relationship of 135°, but the current ratio is varied from equal to 2:3 and 2:1. In this example, each of the three basic design parameters was varied separately to show how each, in and of itself, can create directional patterns.

In proceeding to the design of a particular pattern shape, one may choose to use one, two, or all three of the basic factors in combination. I will not go into great detail relating to the development of specific field patterns since this is of minimum interest to hams. I will leave it to those needing further information in this area to seek it. My main intent is to impart an understanding of the various techniques for producing a given pattern and what the variables are that affect the pattern. There does, however, remain one other factor of great interest to the ham and that is the effect of antenna height.

Relationship of Antenna Height to Radiated Power

The height of the antenna as related to its output power has not been a subject appearing in ham journals, that I know of, yet it is one of interest. For example, with a single tower of 0.25 wavelength in height with an input power of 1 kw at its base, there will exist a field strength of 196 millivolts per meter (measured at a distance of one mile). But for this same power fed to a .5-wavelength element, the field intensity measured at one mile will be 237 mV/m. This is an increase of 41 mV/m over the quarter-wavelength element yet the driving power remains unchanged. Extending the tower to the most effective height of 0.625 wavelength (5/8λ), the tower efficiency becomes 274 mV/m for a power gain of 2.4 dB, a 72% increase in the radiated power. Any further extension of the length produces unwanted side lobes and a drop in efficiency.

In all of the above, ground radials are at least 1/4 wavelength. Figs. 5 and 6 graphically portray the above statements. Curve A in Fig. 5 illustrates the relationship between field intensity and the fractional-wavelength height of an antenna radiating a 1-kW signal. (Disregard curve B as it does not apply to this subject.) For the record, most but not all broadcast antennas are just short of a quarter wavelength in height, and this will be explained when we get into "Radiation Impedance," below.

Rotation of Signal Using Fixed Verticals

In a directional system using two or more driven elements, there is a term called "tower line" which is the bearing (or direction) of the row of towers. It is on this line that the field pattern is oriented. With the use of four towers arranged in a square pattern, one can drive any two and change the tower line and direction at will, a practice often used by ham contest operators.

Radiation Impedance

This brings us to the quarter-wave tower base feedpoint. The radiation resistance of an antenna is measured at the point of maximum current. On a resonant antenna, both the voltage and current fed at this point would be purely resistive with neither a capacitive nor inductive component, $R + jX_o$. This is the

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point that many hams regard as the 50-Ohm impedance point, and some try to force the issue by placing a vswr-indicating instrument at the source end and then, with some dismay, purchase an antenna tuner and proceed to reduce a 1.6:1 vswr or higher to unity.

Wrong! What they successfully did was to provide a conjugate match between the source impedance and the transmission line. The vswr is still 1.6 to 1 or whatever it was at the onset.

We will ponder this further after first investigating the feedpoint impedance of a quarter wavelength with a ground system of 120 radials. The actual impedance of such an antenna measured at its base feedpoint is 36.5 + j22 Ohms. The + j22 in the impedance value indicates that the antenna is not truly resonant but has 22 Ohms of inductive reactance vectorially added to the antenna resistance. The indication shows that the antenna is somewhat long. If the antenna looked like R + jX_o, it would be purely resistive with neither an inductive nor capacitive component, and all of the power getting into the antenna would be effectively radiated.

Let's drop back a bit. Broadcast stations using quarter-wave radiators do not in reality have quarter-wave radiators but something on the order of 0.22 and 0.23 wavelengths. Resonance actually occurs between these two figures, and at this length the radiation resistance is actually 32 + j_o, or 32 Ohms of pure resistance. I can hear the question. "What vswr is that when fed with a 50-Ohm transmission line?" It's 1.53:1. Later I will explain why it is nothing to worry about. The commercial stations don't, so why should you? I will also go into the effects of reducing the number of radials in the ground system.

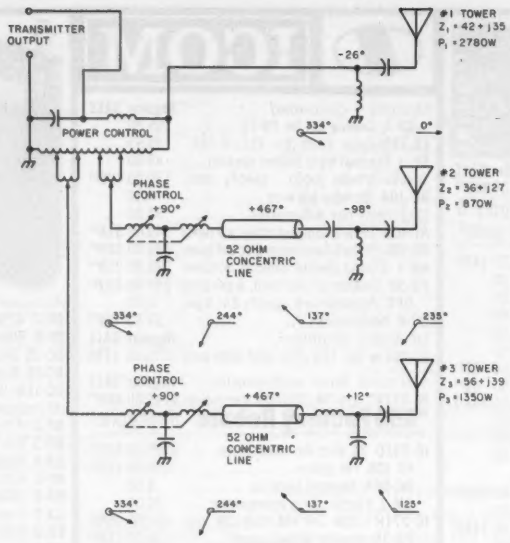

Fig. 7. Three-tower network with in-phase loads.

First, there is another piece of information of interest. You possibly are wondering why I always refer to broadcast antennas. I do this because I am convinced that there is much some of us can learn from the commercial stations, as they have efficient antenna systems and have been designing them for a very long time. For example, here is a small tidbit of information you can reflect upon possibly when measuring your signal at a distance, using a calibrated field-strength meter. I previously mentioned that a quarter-wavelength antenna fed with exactly one kilowatt of power produces a field strength of 196 millivolts per meter (196 mV/m) at a mile distance from this source. Conversely, should we measure the field strength at a distance from an efficient antenna, we should be able to mathematically calculate the power in the antenna that radiated this field strength. The distance then is directly proportional to the current flowing in the base of the antenna.

Taking the radiation resistance of 36.6Ω for a 1/4-wave antenna and using basic Ohm's Law, I = E/R and P/E and $\sqrt{P/R}$. By knowing the field strength of 196 mV/m at one mile, we want to determine the proportional field strength that one Ampere will generate or the number of millivolts per meter per Ampere. The proportional formula with values plugged in reduces to E = 196 mV/ $\sqrt{1000 \text{ Watts}/36.6\Omega}$ = 196/5.23 = 37.5 mV/m/Ampere. Solving for the total current in 196 mV = 196/37.5 = 5.23 Amperes.

According to this, there should be 5.23 Amperes flowing in the base of that antenna one mile from where the field strength was measured. Stay with me a little longer and you will see where this could come in handy.

Back here at the antenna, let's prove that this really is the current in the antenna base. This time we will use the voltage, power, and resistance as measured at the antenna base. We already have all of the formulas: E = $\sqrt{P/R}$ = $\sqrt{1000/36.6}$ = 191/31 volts, I = E/R = 191.31/36.6 = 5.23 Amperes. That's exactly what we came out with in the above calculation. We have correlation. Taking the final step (196 mV/m)/5.23 = 37.48 or 37.48 mV/m/Ampere, which also correlates with the figure of 37.5 above. For those of you who already know this it may have been a bore, but for those who do not, it was good exercise with your calculator.

FCC Rules

In the broadcast field, it is an FCC requirement that stations protect the service area of others that were there on the same frequencies first. Therefore, because of the longer propagation at night, some stations must reduce power at local sunset and some must leave the air. Some stations require such wild field patterns in order to protect the area that they may utilize an antenna system of 12 or more towers laid out in a 4 × 3 pattern in order to protect the service areas of other stations.

Field-pattern requirements are usually drawn on a map of broadcast-station locations. The math to produce the required pattern is exceedingly involved and, even with a fine calculator, would require many hours or days of time to resolve. Therefore, the data is programmed into a computer, and in short order, a multitude of facts, including the magnitude and phase angles of the driving currents for each tower, is obtained. (Actually, there are only a few institutions that will produce plots—for a fee—and there are not too many programmers able to produce the required program for the job.)

Phasing the Currents

Some ham switch-phased arrays use a simple system consisting of varying lengths of coax cable to phase and control the currents feeding the elements. For those interested, Fig. 7 is a typical schematic of a broadcast phasing network used with a three-tower system.

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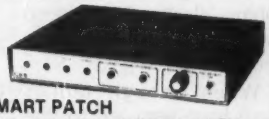

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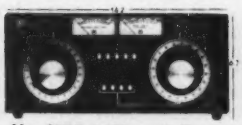

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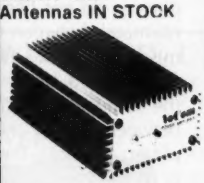

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radiation efficiency is affected when only a few ground radials are used. Let's examine what happens when we use only 15 radials instead of 120. With 15 radials, the ground loss becomes approximately 16 Ohms, and if we remove additional radials, one at a time, the increasing ground resistance increases the total radiation resistance so that we get closer to 50 Ohms, along with reduced swr. Sounds good? This is mistake #2.

When enough radials have been removed for the ground loss to reach 18 Ohms, the total radiation resistance will be 50 Ohms for a perfect one-to-one match. Most hams become very happy and satisfied when they get to this point. However, while the swr went down, so did the radiated power, because now the power is dividing between the 32 Ohms of radiation resistance and the 18 Ohms of ground-loss resistance. Thus the radiation efficiency becomes the radiation resistance divided by the total resistance:

$$n = Rr(100)/(Rr+Rg)$$
$$= 32(100)/(32+18)$$
$$= 64\% \text{ efficiency}$$

Yes, you may have achieved unity vswr and a well-matched line but you are burning up the ground with almost one third of your power. I refer you at this point to the very excellent series of articles by Walter Maxwell W2DU/W8XHK, "Another Look at Reflections," and I encourage you to locate the issues and read them. (See References.)

Compromise Ground Systems

Unfortunately, some of us have to go this route when there just is no place to put the radials. A ground system with only two to four radials, although better than none, may have a loss resistance as high as 30 to 36 Ohms, and it is the ground loss that holds the vswr to the low value of 1.4 or 1.5:1 even though the antenna may be off resonance and over half of your power is lost to ground resistance.

Transmission Line Loss

One often wonders how the pre-WWII ham ever got an antenna system to accept and radiate a signal. You are aware that the vswr indicator wasn't invented until after that war. The neon bulb was the standard way of observing standing waves on a line. It wasn't all that difficult because coaxial cable hadn't been invented, either. The standard transmission line for the ham station was 600-Ohm open wire separated by six inches using oak-wood spreaders boiled in paraffin wax. The vswr on the line was, unknown to the ham, more often than not, 10, 15, or even 20:1. But don't feel sorry; he probably got more signal into the antenna than many hams do today.

Yes, there was always some type of tuner between the final and the transmission line, but this usually was built-in as part of the final amplifier. No, the pi network was not a popular tuner of the time. Well, how is it that hams fared so well without a wattmeter or vswr indicator?

The easiest way I can explain it is that the ham of the time did not know too much nor care too much about the standing waves on the line. The main issue of concern was to keep the rf out of the shack and off the microphone, so this usually meant adding more transmission line to the system in an attempt to get a half wavelength so that the line would look the same at both ends. The real truth of the matter is that 600-Ohm open line is one very good transmission system even in today's world because the loss on the line is exceedingly low.

The biggest villain is not swr at all but line loss. High vswr indicates that a substantial portion of the electromagnetic energy is being reflected back from the load to the source, but with an antenna tuner one can create a conjugate match, thus matching the impedance of the source to the transmission line. This, contrary to popular belief, does not change the vswr on the line one iota. With low-loss lines, the portion of energy lost to vswr is exceedingly small. Repeating: the thing to be concerned with is the attenuation loss in the line. This is the main concern, and once you know what this loss is then you will know how much vswr you can stand before the combination gets significant.

Exactly What Happens

With swr, some of the energy will be reflected back down the line due to the difference of transmission-line impedance and antenna-load impedance. However, the energy going back toward the source will reverse and go back up the line. This process may repeat several times in a matter of microseconds until all of the energy reaching the antenna is eventually radiated into space. With a low-loss line, almost all of the energy will eventually be radiated.

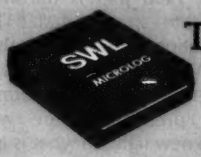
Now the villain. With loss or attenuation on the line, part of that energy is absorbed on the way back down the line and again back up the line, and this is where the bulk of the loss occurs. For example, let's say you have 100 feet of coax and the loss for the frequency is 3 dB; one half of the signal reflected down the line is absorbed, and again, when the remaining portion is retransmitted up the line, another half is absorbed. The swr isn't the element that is sopping up the power, it is the line loss, and 3 dB could be what you wish you had.

This, of course, depends on the type of coax and the frequency you are using. The higher the frequency, the higher the loss. Don't you wish you had 600-Ohm open-wire line? So the next time you are tuning up your antenna and are worried about swr, first consider the loss contributed to line attenuation. There are published charts in most antenna handbooks giving this information.

Other Considerations, and the Good Old Vacuum Tube

The good part about vacuum tubes is that they are very forgiving. Not so with solid-state devices. Therefore, most solid-state amplifiers have built-in safety features like Automatic Limiting Control (ALC). The presence of swr sends back a proportionate out-of-phase voltage that biases the driver so as to reduce the drive or even shut it off should the swr be high enough. A tuner then becomes a must with solid-state amplifiers. Solid-state devices do not like to see a mismatch between the transmission line and the amplifier. Thus, a tuner will give the conjugate match needed between the line and the amplifier, allowing the amplifier to put the full power into the transmission line.

Recently, while reading the mail on a cross-country QSO, the party on the far end stated that he was using a solid-state rig and had an swr of 1.6 to 1 without the tuner. An S-reading was taken by the party in QSO and a second reading was taken after an antenna tuner was switched into the line. I don't remember exactly, but the results were an improved signal strength of about one S-unit, or 6 dB. Actually, the tuner provided a conjugate match between the transmitter and transmission line—the vswr was still on the line. The signal was improved because the transmitter was now transmitting its full power, as the ALC was no longer biasing back the drive to the final.



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Conjugate Match

If the line between the tuner and transmission line were separated or broken, and two impedance readings were taken, one looking back into the tuner and another looking into the line toward the load, the first would see the conjugate of the impedance seen in the opposite direction—R + jX in one direction and R − jX in the other. The conjugate match has made the internal resistance of the source equal to the resistive component of the line, and all of the residual reactance components have been canceled to zero. When these conditions are met, all of the transmitted power enters the line.

Walter Maxwell graphically illustrates (and, I think, conclusively) another example of vswr equated with line loss. Using his example, 80 meters is a very wide band and an antenna would have to have an exceedingly poor Q to be reasonably flat across it. If a dipole is cut and resonated at 3.75 MHz (the center of the band) and fed with 100 feet of 50-Ohm RG-8/U coax, the vswr at both ends of the band (3.5 and 4.0 MHz) will be about 5:1. The loss in the coax adds only 0.46 dB to the matched or flat line loss of 0.32 dB at 4.0 MHz. So, at the band ends the loss is equal to 1/12 of an S-unit because of vswr. Not very much to be concerned with is it? Not at all what many hams would expect, so why would one worry about a 5:1 vswr under these conditions?

If the final amplifier is unhappy with the condition, match the line to the amplifier by use of a tuner, but remember that although this also may make you very happy, you still have 5:1 swr but are transmitting just about all of the electromagnetic wave.

With all of this freshly in mind, you might ask yourself the following questions:

1) What attenuation is introduced to my signal between the final amplifier and the antenna?

2) What is my vswr?

3) What is the loss due to swr alone?

4) What is the total loss due to swr and transmission-line loss?

5) To what extent is my solid-state power amplifier powered back due to swr?

6) Do I need an antenna tuner?

7) What is the ground-loss resistance?

8) What is my power loss due to the proportion of ground loss to antenna resistance?

9) What is the radiation resistance of my antenna measured at its current feedpoint, less the ground-loss resistance?

Now, if you want to know more about the magnetic field, the electric field, and the combined electromagnetic field that is transmitted into space, read "The Radiation of Radio Signals," by W1GV (see References.)

I trust that the information presented here will shed new light on what is going on in your antenna system and provide significant points to consider for improving the situation. ■

References

1. "Exploring the Power Myth," Hubert K. Woods W9IK, *73*, May, 1976. (Note: There is controversy between W9IK and W2DU on this point.)
2. "Another Look at Reflections," Walter Maxwell W2DU, *QST*, April, June, August, October, 1973, and April, 1974.
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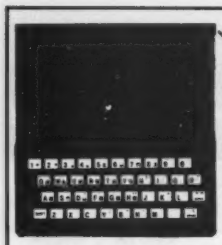

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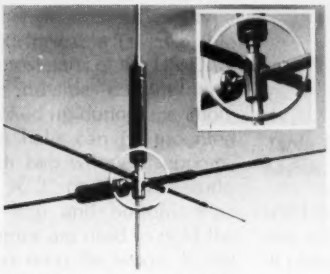

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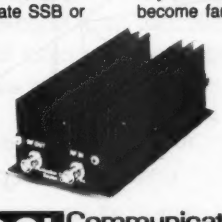

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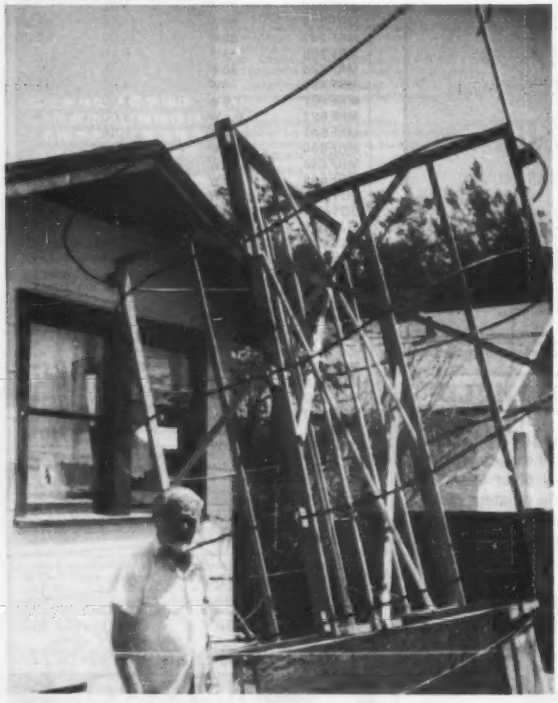
Ollie's Folly

Circular polarization on HF? A forty-meter helix with oil-drum forms? W1ZB's signal runs rings around the rest. Folly, indeed!

Circular polarization is very old, almost as old as radio itself. In 1953, I was working for the leading radar antenna company and was hired by the US Government to evaluate circular polarization. After two years of extensive field tests, circular polarization was found to be superior for transmission and reception over mountains and through rainstorms. When satellite tracking stations came into existence in the late 1950s, circular polarization was used exclusively for Doppler-effect receivers and is still in use today.

Twenty years later, I wondered why not use this same principle on high-frequency receivers and transmitters. If it works well on VHF, it will work well on HF. The only limiting factor is the size of the array for HF. After many years of experimenting in the Mojave Desert and on my antenna farm at Otter Creek, Maine, we have working models for most of the HF bands.

VHF antennas have always used one wavelength for the circumference of the helix. After much trial and error, we have found that HF, circularly-polarized antennas will work very well with a circumference of one-half wavelength. The tuning is very broad and will cover two bands.



The author and his 20-meter helix.

Construction

The best thing to use for

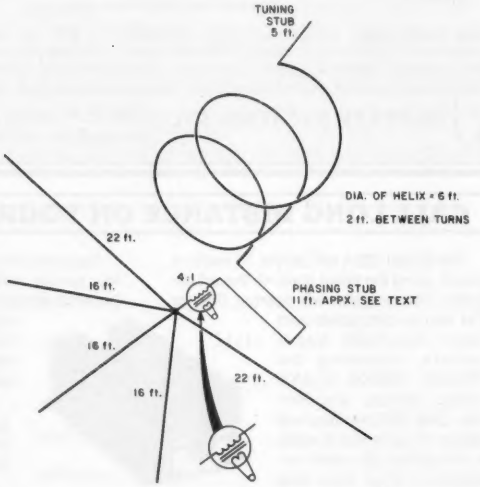


Fig. 1. Circularly-polarized, ground-mounted antenna for ten and fifteen meters.

the helix is a 3/4" rigid or semi-rigid coax of the type used for cable TV, available in most parts of the US. Only the outside conductor is hooked up during operation. The helix can be mounted with two wooden supports, 2" × 2" or 2" × 4" studs, for top and bottom. Pipe clamps are used to hold the coax onto the wood. It can also be hung on a slanting rope between trees. The wire used for the reflectors can be #18, #16, or #14 copper wire, covered or uncovered. The phasing section is a one-half wavelength of TV line (300 Ohms) resonated (dipped) with a MOSFET dipper or grid dipper to the frequency. The line is then coated with two coats of varnish to protect it from the weather.

In winding the helix, I used a big oil drum and a big water tank to wind it into shape. We had quite a search all over town to find something big enough to wind it around. Working the two sections of the antenna in phase results in a superior field pattern with a narrow beam of high intensity. Gain is 2 dB per turn. Use seven turns if possible, although a three-turn helix will work well.

Band	Diameter of Helix	Approximate Phasing Stub Length
40m	20 ft.	32 ft.
20m	10 ft.	16 ft.
15m	7 ft.	11 ft.
10m	5 ft.	8 ft.

Table 1. Construction dimensions for circularly-polarized antennas.

The helix must be tilted at a 30-degree angle, otherwise all your power will go into the ground. A balun or tuned feeders work fine. The antenna is ground-mounted, with the base of the helix a few feet off the ground. The reflectors are a few inches off the ground with the center one slanted backwards in an almost vertical position. Two wooden posts are used to hold the front end of the helix at the proper angle of 30 degrees.

Tuning

When the antenna is completed, couple the grid dipper or noise bridge to the balun with two turns of wire. The balun ratio is 4:1. Adjust the stub at the end of the helix for resonance. It should be very broad. Tune it for 21.4 MHz and it should work on 10 and 15 meters. Coax/balun feed and tuned feeders have both worked well.

After eight years of testing, I can safely say it outperforms any yagi or quad of the same size. A 10-ft.-diameter helix works well on 20 meters.

$$L = n\sqrt{c^2 + s^2}$$

$$L = \sqrt{a^2 + (n\pi d)^2}$$

where:
n = number of turns
c = circumference of each turn
s = lead or spacing of turns
a = length of the helix
d = diameter of the helix
L = length of rigid coax

Fig. 2. Formulas used to determine the optimum dimensions for circularly-polarized antennas.

No matter what kind of antenna you have, the polarization of the received signal a thousand or more miles away will be different from the one sent out by your antenna. Extensive testing of dipoles and beams over a path of 500 miles has shown the signals to be coming in at a 45-degree angle on most HF bands. The circularly-polarized antenna was better able to cope with this phenomenon and showed a remarkable gain over any conventional antenna. ■

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Build a Better Box

Most hams cram their circuits into any old case that's handy, but a little planning can turn a so-so project into a masterpiece of packaging.

The projects we design and build are often electronically better than their commercial counterparts. Often they just don't seem to be as good because we fail to take the trouble to package them so that they will give us the operating convenience, appearance, and safety of commercial gear. Granted that very complex projects involving combinations of rf, af, and digital circuitry do require fancy cases and extensive internal cabinets to shield one circuit from another. However, for most simpler ham projects we can do just as well as the factories in mounting our electronics in cabinets that are convenient, safe, and attractive. And we can save money in the process, whether we build or buy our cabinets.

There are many ways to make good project cabinets or to mount projects in them, but a number of basic ideas can open up our imaginations to improve our gear. Let's take a look at some principles and ideas that I have accumulated over the years. Since I am not an expert in metalwork, all the ideas below will work for anyone with no more than two or three thumbs per hand. The basic mechanical tasks of building up the final stages of a project are not difficult, so if you have some special skills, you can expand on these ideas in ways I probably have not even dreamt of.

What's a Good Cabinet?

A good project case or cabinet is more than an attractive shell to surround electronic circuits. We place our circuits in cases in order to meet some very special needs. Therefore, we should begin thinking about project cabinets even before we build the circuits to go in them. If we are reproducing a circuit from a magazine, the author's version may give us some good ideas, but let's not stop there. We will be using the project we build. We should design the cabinet to meet our own special needs, not those of the author. There are five major jobs for the cabinet.

Function: A cabinet must permit the electronic project to perform its function effectively. In fact, the cabinet should enhance the function. If there are controls, all of them should be accessible to us according to how often we need to operate or adjust them. All controls should be well spaced so that we do not maladjust one control while using another. We must have access to connectors as well as controls. Often-used jacks and plugs need to be where we can reach them easily without interfering with the controls. If there are meters or other readouts, we must place them for convenient monitoring. Our care in designing a case that will hold all these controls, readouts, and connections will determine how useful the equipment will be to us in the long run.

In the era of boat anchors—when huge cabinets full of tubes provided large panels—we could place almost every control, meter, and jack on either the front panel or the rear lip of the chassis base. In today's world of miniature electronics, panel components may occupy more room than all the circuitry put together. For many small projects, the front and rear panels may provide enough room for controls. However, there is no rule that says we have to restrict ourselves to these surfaces. Any surface on the case that makes a panel component accessible (without creating special building problems) is eligible for use. A new generation of commercial sloping-front cabinets offers the builder new options in packaging. We can use these cases—or home-brew equivalents—to improve the basic performance of our projects.

Support: As in the beginning of electronics, the cabinetry must still support the electronics. A case provides surfaces to mount the chassis and circuit boards on or against. Just mounting circuits to get them out of the way is not enough. We should plan access to the circuits for adjustment and repair. We used to mount all the individual parts of complex transceivers on one chassis base. Today, we tend to use numerous subassemblies consisting of circuit boards and small metal enclosures, each interconnected by cables. To make repairs, we should only need to dismount one of the subassemblies.

The cabinet must not only support these boards and subassemblies, it must also give us access to them. One common problem for new builders is the urge to strive for excessive miniaturization. We cram together all the parts in minimal space. As long as everything works well there seems to be no problem, but such units are susceptible to mechanical shock damage. And we dare not open the case for repairs lest the tangle of parts and wires engulf us. A good cabinet supports our work neatly and in a way that minimizes potential damage to the circuits.

Shielding: We have mentioned using small metal cases within the project cabinet. This is just one way to

keep circuits isolated from each other when there is danger of an undesired interaction. A digital readout in a transmitter requires careful isolation. Vfos need isolation from both electrical and mechanical interaction. Other circuits may require less shielding; an aluminum sheet used to support a circuit board may also supply all the necessary shielding. We must also watch out for interconnecting cables; keeping the signal leads short, direct, and shielded. The power-supply lines, traditionally cabled together and run around the perimeter of a chassis or cabinet, are susceptible to signal pickup and transmission. We need to use care not only to bypass all power leads, but also to route them where they can create the fewest problems.

A good project cabinet must make room for all these adjuncts to the circuitry. Without room for shielding and isolated cable runs, even the best circuits are likely to give us surprising and undesired results. Size is not the only factor. A cabinet must provide surfaces that can support shields and subcases and permit good metal-to-metal contact to ensure a common ground for the project. Not all projects require such attention to shielding. Many circuits are totally noncritical in this regard, and thus can live comfortably in non-metal environments. Some thought to shielding will go a long way in our efforts to select the right cabinet for the job.

Appearance: A ham project is a work of pride. You should dress up your project so that even if shack visitors cannot see the magical electronic innards, they can appreciate the external workmanship. Care and neatness with cabinet construction and lettering add to both function and appearance. You can improve appearance without special skills. Touches of wood framing on the cabinet will humanize metal boxes. Some simple masking and spray painting can customize a project. You can either match the general appearance of the commercial gear that forms the nucleus of the shack or you can express your own personality in your cabinets. In fact, with a few custom touches you can add some fun to the function of your projects.

Safety and Security: The last—but not least—major job for the cabinet is to make our project safe for ourselves and others who enter the shack. We enclose electronic circuits in cabinets first *to protect people* from shock and other hazards, and only second to protect the circuits from people. Even today's low-voltage solid-state circuits hold potential for human harm if carelessly handled. Some people are more sensitive than others to electrical currents, so we should never assume that 5 to 12 volts is safe enough for open circuitry. Adults are curious enough, but children simply cannot keep their hands out of things. We need to think not only about the case itself, but about current-carrying connections as well. The project cabinet, when all is said and done, can be an expression of love and protection for the people around us.

A little thought to these requirements for cabinets will help us select or design just the right case for our current project. There is a large number of commercial cases on the market. Some are traditional cabinets with front and rear panels that detach independently. Others make use of fewer metal pieces by forming the bottom and top from two U-shaped pieces of aluminum or steel. Painted and unpainted utility boxes come in sizes from just over an inch on each side to about 8″×8″×8″. Some cabinets have shadow tops that extend beyond the edge of the front panel to prevent glare from overhead lights. Of course, there are the classic rack panel and cabinet, but these are so large and heavy that they have become special-purpose and laboratory items. The average ham may use them only if he is building a large and heavy piece of gear such as a linear amplifier and power supply. Even then, there may be better cases to buy or build.

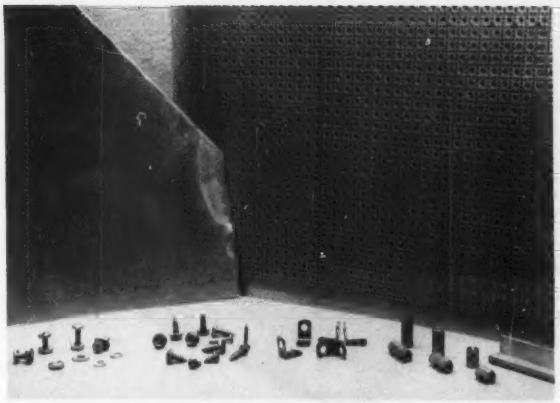

Photo A. Some common items used in cabinet construction (from left to right): 6-32 hardware, sheet-metal screws, L-brackets, standoff pillars, and angle stock. In the background are sections of flashing and perforated metal.

Some of the more recent cabinet innovations open new doors to imaginative packaging. One line of cabinets from Ten-Tec uses a combination of materials, with the front, rear, top, and bottom dividing in unconventional ways. Other cabinets, from a variety of manufacturers, use sloping panels that range from near vertical to almost flat. A few use a combination of slopes to provide room for the combination of keyboards and panel controls. For most of these new ideas we must pay a premium, and these cases are usually accessible only through mail-order sources. Local stores such as Radio Shack carry a limited number of cases, mostly for smaller projects. However, if a cabinet will make the difference between a successful, often-used project and one that gathers dust in the corner of the shack, the extra cost is justified.

Over the years, we will use many different types of cabinets for our projects. Some circuits will be wrapped in commercial cases. Others will be put in one-of-a-kind cabinets. Still others will go into cases that are a combination of both. The materials available are readily adaptable to modification, and the more we perfect our cabinetry thinking, the more materials we will discover to be useful in packaging our projects.

Home-Brewing Cabinets

The whole idea of building a cabinet for a project may seem scary at first. However, the skills, tools, and materials are all fairly easy to acquire—if we do not already have them. Patience and neatness may be the hardest items of all to develop, but with them we can be successful on nearly every try.

Any number of materials will come in handy in cabinet construction. Solid aluminum sheet ranging from 16 to 20 gauge (.05″ to .03″) is the most common material. Steel in 18 to 22 gauge

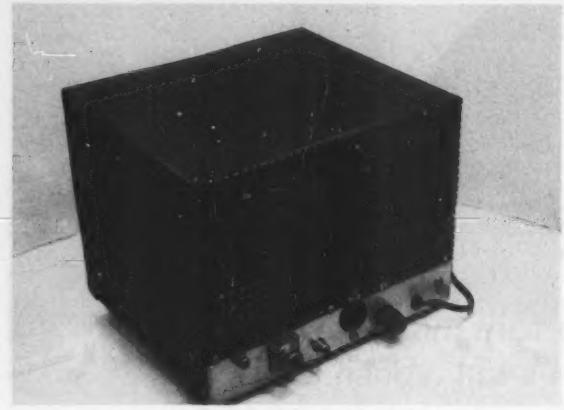

Photo B. A CW transmitter using a home-brew panel and perforated-aluminum shell around a commercial chassis base.

has the same thickness range but is harder to work on without tougher tools. Metal shops in your local area may be able to supply small quantities of sheet metal fairly inexpensively. If you get to know the shop people, they can give you good advice on working the material. Perforated aluminum is available from some hardware stores and makes a good shield at lower frequencies. It is thin enough to work by hand, but it will not support controls. Aluminum flashing is also very thin and workable and makes good subassembly enclosures and solid shells. Building-supply stores usually stock this, and it can be cut with heavy shears.

Metal is not the only good material for cabinets. Not only will you find plastic cabinets in radio-parts stores, but you also will find them in five-and-dimes if you learn to look. Kitchen supply, household goods, and home/office supply departments carry a variety of plastic boxes and enclosures, many having just the decorative touches to make your project attractive. If you do not need the cabinet to serve both as a shield and as an enclosure, do not overlook these sources. Similarly, if your cabinet does not have to double as a shield, wood is an attractive cabinet material (as a look at any antique radio will attest). Do not be afraid to try something different, even if commercial manufacturers have turned away from such techniques for economic reasons.

The actual process of making a cabinet is not difficult. Let's look at several different styles of cabinets we can make in our shops or even on the kitchen table. We will need a few tools in addition to those we keep in the shack. Here is a list:

- Hacksaw
- Saber saw with sheet-metal blade
- Small metal brake
- 1/4- or 3/8-inch electric drill and bits
- Scrap wood, e.g., a few feet of 1 × 4 pine or fir
- Clamps (to hold metal to the wood or brake)
- Files: flat and half-round in several sizes

(This list assumes that the usual collection of screwdrivers, pliers, and other common household tools are available.)

We can make some cabinets without bending a piece of metal. Fig. 1 shows the general idea. Using 1/2"- or 3/4"-wide aluminum angle stock available at metal shops, we can cut the pieces for a cabinet frame. The detail in Fig. 1 suggests how to cut the ends of the stock to bolt pieces together with 6-32 or 8-32 hardware. Cover the frame with solid- or perforated-aluminum sheet, depending upon the needs for each surface.

Fig. 2 shows a similar use of perforated aluminum where a chassis base supports the project circuitry. Attach a 16- or 18-gauge piece of aluminum to the chassis to serve as the front panel. Then, for a shell, cut and bend perforated aluminum. Use 6-32 nuts and machine screws to secure the seams of the aluminum. Then fasten the shell to the chassis with no. 6 sheet-metal screws. The shell forms a shadow lip over the panel. Although the shell will not withstand physical abuse, there are many applications where this construction works well. We can stiffen the edges by adding common 3/8" angle brackets (available at radio-parts shops) every few inches at the bends, seams, and especially near the corners. (Photo B shows a small home-brew CW transmitter that uses this technique.)

For both these cases, you need only heavy shears, a saber saw, and a hacksaw. Cutting work is easier if you clamp your work to a bench or another solid surface. A bench vise to hold the angle stock for cutting is recommended, but you can use clamps to hold it to the edge of a bench. Cutting will always leave burrs and sharp edges: bevel them with a file.

Since all these operations leave handprints on the metal surface, you should think about painting the finished product. There are solutions which clean aluminum, but the simplest procedure may be to use very fine (000) steel wool on the surface and then spray paint it. Use sev-

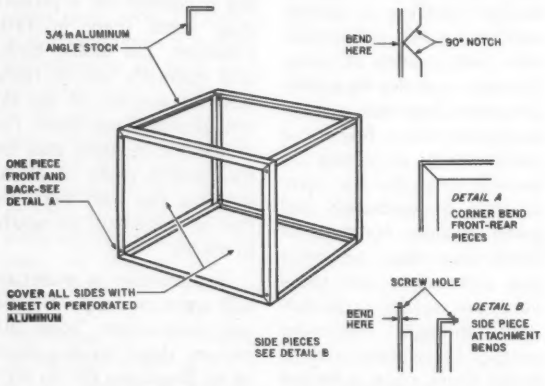

Fig. 1. A simple cabinet frame, covered with sheet or perforated metal.

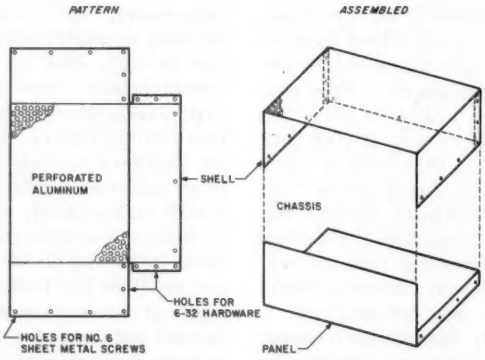

Fig. 2. A perforated-aluminum shell for chassis and panel.

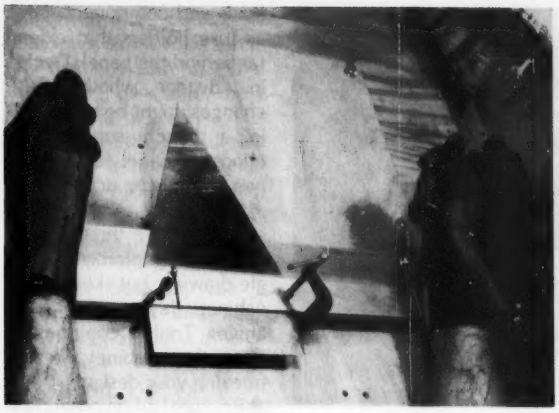

Photo C. A metal-bending brake in action; note the use and position of clamps and the method of operation.

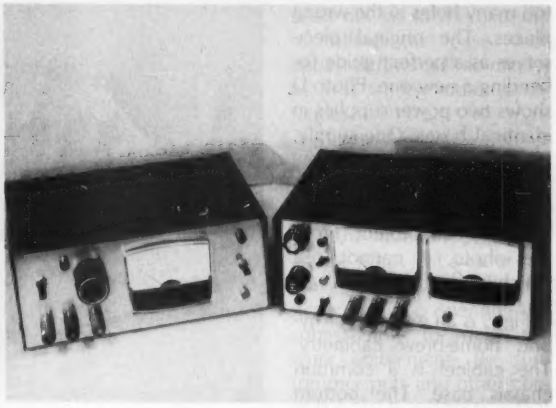

Photo D. Two power supplies. One of these look-alike units has a home-brew sheet-aluminum panel (U-shaped bottom piece).

eral very thin coats rather than the one thick coat that inevitably runs. If you use just one or two passes of a pressurized can of spray paint for each coat, you can build up a textured surface in about five to seven quick-drying coats. A large cardboard box makes a good disposable paint station to catch the excess spray. Of course, delay any painting until you have done all the necessary drilling and cutting on your panels.

So far, we have not used the metal-bending brake. Bending brakes are simply devices for making long, even bends in sheet metal. Small cast-aluminum hand brakes for light-metal work are available for about $25.00 from mail-order tool suppliers. If you have larger work, you may want to pay a metal shop to make the bends for you with its sophisticated heavy-duty equipment. For small aluminum cases as well as shields and plates that require a mounting lip, the light brake is handy. The brake usually has a clamp bar to hold the metal in place. As Photo C shows, the movable part of the brake bends the metal sheet evenly. Use steady force on both levers in order to bend the metal smoothly. The clamp bar usually will permit you to bend the metal slightly more than 90° so that the metal returns to a true right angle when you release bending pressure.

To make a box, design two U-shaped pieces. You can add a lip to the bottom piece in order to seal the box with sheet-metal screws, or you can add lengths of aluminum angle stock to receive the closure screws. Fig. 3 shows the unbent and bent pieces. Use 18-gauge aluminum which works easily and provides good support for small projects. If you examine inexpensive commercial enclosures, you will discover that they are designed in almost exactly the same way. Add holes for controls and connectors, a coat or two of paint, and lettering to identify the knobs—and the enclosure is complete.

Fig. 4 shows a slightly more ambitious box with a shadow top and lips on several sides to receive sheet-metal screws. This enclosure requires several bends per piece. Make the lip bends first. Then cut from scrap aluminum or steel stock a special clamping bar to fit within the lips so that you can make the large bends. Note that the lips do not go all the way to the ends of the pieces so they will not interfere with the large bends. This box provides a tighter electrical shield for the circuits inside.

Often, you do not need to construct an entire cabinet. As time moves on, you will accumulate old cabinets from projects that have outlived their usefulness. One or more pieces of an enclosure may be in excellent shape. You need only replace the parts which have

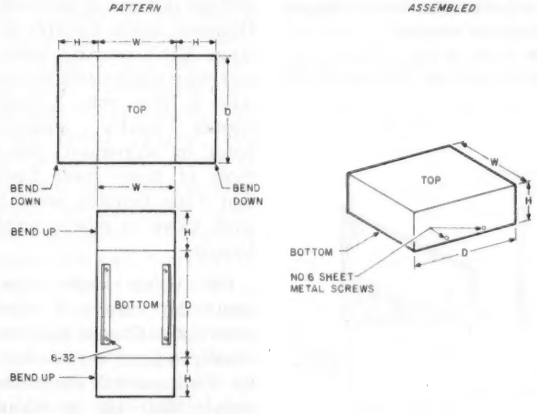

Fig. 3. A simple cabinet made from two U-shaped metal sheets.

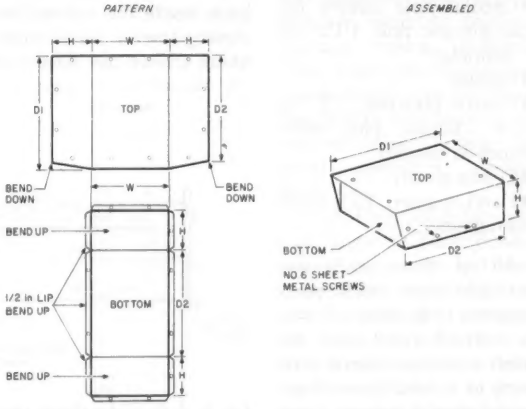

Fig. 4. A more complex version of the cabinet in Fig. 3.

too many holes in the wrong places. The original piece serves as a perfect guide for bending a new one. Photo D shows two power supplies in identical boxes. One supply, however, has a home-brew aluminum bottom to go with the dark top left over from a dead project. From the photo, I cannot tell which is which.

Fig. 5 is an example of hybrid home-brew cabinetry. The cabinet is a common chassis base. The bottom plate is perforated aluminum. With a coat of paint and cutouts, this unit holds a CW keyboard. The decorative wooden end pieces, stained and varnished to match other furniture in the shack, are also functional. By screwing the chassis to the end pieces at an angle, the unit provides a sloping panel to match the keyboard slope. Yet the entire cabinet costs less than a quarter of the price of comparable commercial keyboard cabinets. Photo E illustrates the finished unit.

Panel Work

Now that you have a cabinet, whether home-brew or commercial, the next step is to make the cutouts for controls, connectors, and readouts. This job requires a bit of planning and some patience. There are a number of additional tools that will make the job easier:

- Circular hole cutters for your electric drill, 1-1/2" to 3" diameter
- Nibbler
- Chassis punches, 1/2" to 1-1/4" circular, plus other shapes as needed
- Center punch
- Hand reamer, 1/2" maximum diameter

All of these tools are available from major parts suppliers or hardware stores. As with all metal work, be safety conscious. Clamp your work to a solid base. Wear safety goggles to keep chips out of your eyes. I also recommend that you wear gloves, since burrs and freshly-cut metal edges will cut skin very easily. Keep your tools clean and sharp. Dull tools are more dangerous because they slip more easily. Finally, keep your attention focused. A dull or tired mind can be the most dangerous tool of all.

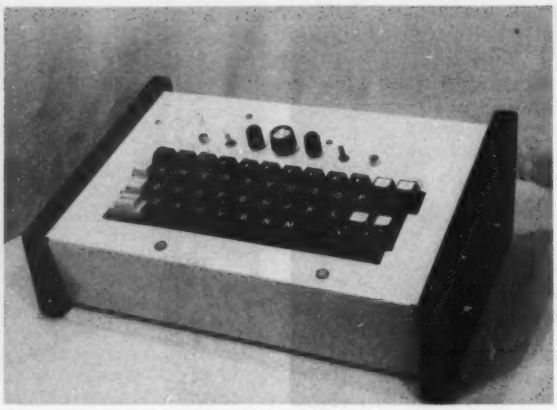

Photo E. A hybrid cabinet using a chassis base and wood end pieces to support a home-brew CW keyboard.

Before cutting a cabinet panel, make several sketches of your desired cabinet layout to be sure all the holes you cut will be exactly where you want them. Paper is much cheaper than ruined cabinets. In drawing your layout, there are a number of matters so obvious that every builder overlooks them occasionally. Here is a starter list. Your own mistakes over the years will give you additional entries.

- Be sure to leave clearance inside the cabinet for closing screws. Some sheet-metal screws can extend up to a half inch inside the cabinet, which would jam circuit boards or short out wiring.
- Beware of controls and jacks that come too close to closure screws.
- Leave room for finger access to any interconnections between subassemblies. Allow for in-line connectors if your project uses them.
- Allow clearance between subassemblies not only for maintenance, but also to compensate for minor inaccuracies in cabinet cutting and drilling.
- Leave clearance for controls or switches and for their connection terminals. When laying out a panel, it is easy to forget that a control extends behind the panel as well as in front of it. Plan your panel by the control size, not by knob diameter (unless the knob is bigger than the control).
- Even in low-voltage projects, use care with lethal ac leads and components such as fuse holders that extend far behind the panel. Decide in advance whether fuse changes might be regular (as in a bench supply) and choose a panel fuse holder or a chassis clip accordingly.
- Remember that subassemblies have three dimensions. Do not plan with a single drawing, but sketch your cabinet layout from all angles. Trial-fit components into the cabinet before freezing your design.
- Be sure all exposed terminals inside the cabinet will be free and clear of possible short circuits.

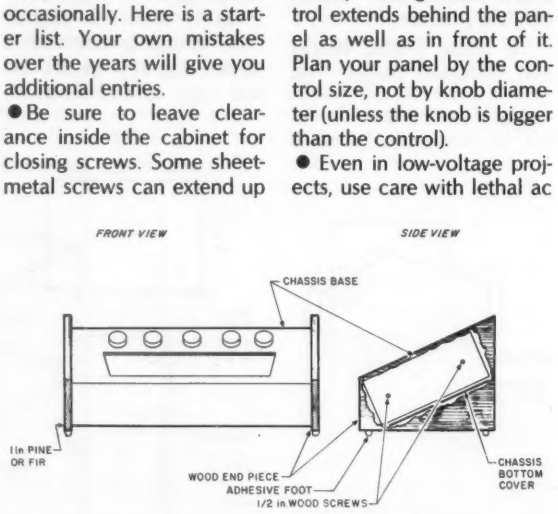

Fig. 5. A hybrid cabinet using a chassis base with wood end pieces.

The list is not complete but is long enough to give you an idea of what can go wrong in the absence of proper planning. I have made each of these mistakes at least once. (A few more embarrassing errors I have omitted from the list.)

Draw your drilling and cutting plan on the cabinet pieces using a center punch to mark all holes. I generally begin cutting using the smallest drill bit that corresponds to a hole, usually a 1/8" hole for 4-40 machine screws or a 9/64" hole for 6-32 hardware. Use a drill bit one size smaller for sheet-metal screws. Then enlarge the holes as needed. Modern miniature controls require 1/4" mounting holes, so a 1/4" chuck in an electric drill will do most of the work. However, some controls require 5/16" or 3/8" holes, and older toggle switches require a 7/16" hole. A hand reamer readily enlarges holes in aluminum. Since most of these tools have thin T-bar handles, wear a work glove to relieve hand fatigue.

For holes larger than about 3/8", we will need other tools. Chassis punches usually require a 3/8" hole for their central shaft (for punch sizes up to about 1-1/2" diameter). We can cut larger circular holes with

drill-driven hole cutters (or hole saws, as they are sometimes called). Starting with a small (1/8") pilot hole, these cutters drill a larger guide hole and cut out the full-size hole with a heavy circular sawtooth fixture. To keep the metal from tearing as the saw cuts through, clamp the panel to a scrap of wood. If possible, use a slow-speed drill and keep the work cool with a drop or two of oil.

You can cut square or odd-size holes with a nibbler, a hand cutter that takes a 1/8" × 1/4" bite of metal at a time. Panel cutouts usually require a 5/16" starting hole. Then a steady hand and patience will permit a fairly accurate cutout. Leave just a bit of metal for filing. In fact, all cutting tools leave burrs and edges that you will want to file smooth. Filing is a boring job and there is a temptation to cut burrs out with a pocket knife. However, to avoid nicks and panel scratches as well as to achieve perfect holes that precisely fit the components, use round and half-round files along with a good bit of patience. Be sure that the burrs are gone because they can cut the plastic cases of panel instruments (such as meters), and they will affect the way metal panel components fit.

Many of these same tips apply to working with plastic, although a few special cautions are in order. Plastic in the early days was often so brittle that drilling shattered it. Today's plastics are more varied, tougher, and better suited to serving as cabinets for electronic projects. The soft plastic used for test-bench instrument cases drills well. You can cut larger holes often by starting with a smaller hole and whittling it to true size with a sharp knife. These techniques do not usually work well with more brittle plastics. Punching and nibbling are out. However, most modern plastics will withstand careful drilling. If you need a panel full of large or unusual holes (for meters and such), try replacing part of the plastic case with a metal panel.

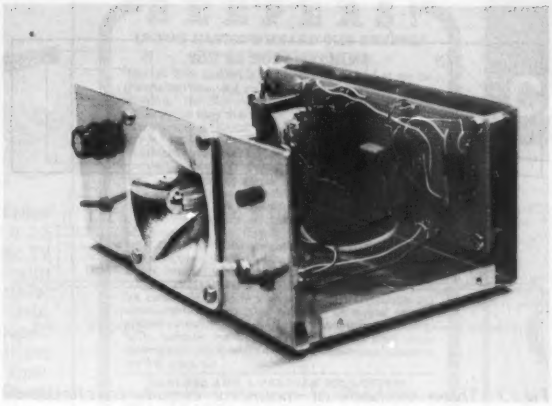

Photo F. An ultrasonic bug chaser with the circuitry mounted against the rear cabinet wall.

Plastic, of course, provides no shielding for circuitry. Aluminum flashing, however, can provide internal shielding beneath the attractive plastic exterior. Fig. 6 shows an example of flashing which is cut and bent to form a shield for a subassembly inside a plastic case. Thin shielding works as well as thick metal, and the commercial trend seems to be to save money by using plastic for structural duty and the thinnest metal (including foil) for shielding. The ease of working with lighter materials suggests that commercial practice may hold a few lessons for ham builders.

Mounting the Circuit Boards

Assuming that you have built up your circuits on some appropriate surface (printed circuit boards, perfboards, terminal strips mounted on board or metal, or a chassis) you are ready to mount them in the cabinet. However, there are two planning questions we have not yet asked. How will you mount them? Where will you mount them? There are many good answers to both questions, and your job is to select the right answer for your project.

Support: Every piece of circuitry deserves a stable and secure mounting to guard against movement inside the cabinet. The advantages are obvious. Movement permits physical damage and shorts among the wires. Manufacturers encase microcircuitry in epoxy to stabilize all connections and prevent parts from moving relative to each other. We should do no less inside our cabinets, although we need not go to the extreme of filling the case with epoxy. Screws will do nicely, as will a few other techniques.

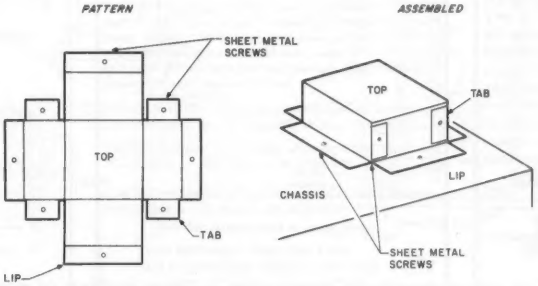

Fig. 6. A simple internal shield made from aluminum flashing.

Access: As noted when we looked at cabinets, subassembly mounts should leave us room to connect and service the modules. However, access is not just a matter of leaving enough room for work. It is also orienting the subassembly to make the work convenient. Be sure trimmer pots and other controls point in a direction that allows easy adjustment. Do not create tiers of circuitry boards without a method of easily removing the top layers. Modular design holds many advantages, but it can lead us into many snares if we do not plan carefully.

Isolation and interaction: How we position subassemblies within a case can determine the degree of interaction between circuits. Two boards face to face are more likely to interact than two at right angles to each other. Placing audio circuits close to an unshielded power transformer is a good method of ensuring ac hum in the output. Oscilloscope tubes use mu-metal shields and distant placement of power transformers to prevent magnetic deflection of the scope beam. Vfos and other oscillators in receiving and transmitting circuits require full-scale shielding and isolation from circuits that are likely to produce spurious mixing products. These examples should spur you to think carefully about the relative positions of all subassemblies in order to avoid unwanted interactions.

Heat: Even solid-state circuits generate heat. Power-supply components and power-amplifier transistors are now the main heat sources, but even micropower circuits require a little breathing space. Since hot air rises, leave a vertical path for its climb into the world outside

the case. Add a few ventilation holes to cabinet bottoms so cool air can replace the hot air. Consider mounting power transistors on the rear wall of the cabinet with suitable heat sinks, but be sure the component cases will be electrically safe. Every degree above room temperature is an unnecessary stress on components. Trapping hot air around components can shorten lives and, of course, they will die just when you most want to use the circuit.

Lead length: Wherever possible, avoid long signal leads between subassemblies or between panel controls and boards. Where you must use long signal leads, shield them. Many newer designs are replacing signal leads to controls with special circuits that permit control leads to carry only dc. How you mount your subassemblies will determine how long the leads need to be and where on the subassembly the lead terminals should be. There are many projects in which these considerations are noncritical, but be sure of this fact before you permit a maze of long leads to run between boards.

With these thoughts in mind, we can tackle the hows and wheres of mounting your circuits inside the case. How to mount a circuit depends upon its construction and what surrounds it. Let's survey a few of the more common techniques.

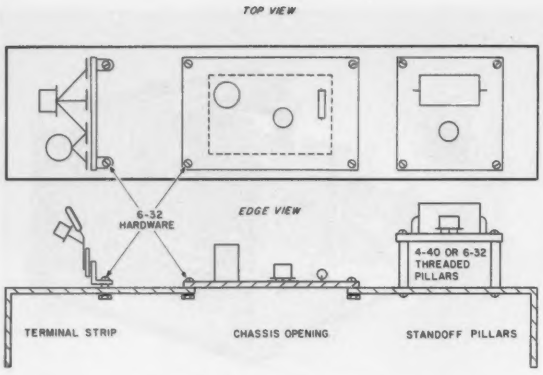

Fig. 7. Three methods of mounting circuits to chassis or plates: terminal strips, chassis cutouts, and standoff pillars.

Fig. 7 shows some of the more common techniques to use with a chassis base or flat metal plate. Point-to-point wiring using terminal strips bolted to the chassis or plate is still a handy construction method for many projects. Perfboard and PC-board circuits can be mounted in chassis cutouts, with 6-32 hardware to secure the boards at their corners. If you do not want to cut the chassis, you can mount boards on pillars that are long enough to ensure clearance for all the terminals on the board. This method has the additional advantage of providing a shield between the board bottom and wiring on the other side of the metal plate.

For mounting boards inside a cabinet, Fig. 8 offers several common methods. These are numerous experimenter PC boards equipped with fingers to fit PC-board sockets. These sockets mount on rails to clear their terminals; however, you can place them on standoff pillars to mount on the bottoms, sides, or backs of cabinets. L-brackets provide a convenient method of mounting light circuit boards. Two boards secured back to back with standoff pillars provide four L-bracket feet. This mounting will be more stable and will carry more than twice the load of a single pair of L-brackets. A simple adaptation of this technique provides a shield between the circuits in the form of an 18-gauge aluminum plate which attaches to the cabinet surface.

Fig. 9 shows some simple methods of mounting subassemblies. L-brackets and 6-32 hardware secure small boxes to cabinets or chassis, as do carefully placed sheet-metal screws. Even panel controls protruding through the subassembly box can supply a good hold for light circuitry. However, we do not always need hardware since a little foam material can hold a circuit board in position if we are careful not to stress any tall or fragile components. This technique is often useful with plastic enclosures or small subassembly boxes.

Each of these techniques has its advantages and limitations. Circuit-assembly weight, the need for inflexible mounting, requirements for shielding, and other factors determine the right mounting for each circuit. Also, where the circuit belongs in the cabinet has a bearing on the mounting method you choose.

The first idea to throw away is that you must bolt your circuit board or chassis flat to the bottom of the case. This holdover from the days of tubes and chassis bases has only limited application today. It applies to power supplies and other circuits using heavy components. Lighter circuits can mount against almost any surface of the cabinet and in almost any orientation. Some of the photographs may be suggestive of the possibilities. Photo F, the ultrasonic bug chaser, shows the circuitry board mounted against the

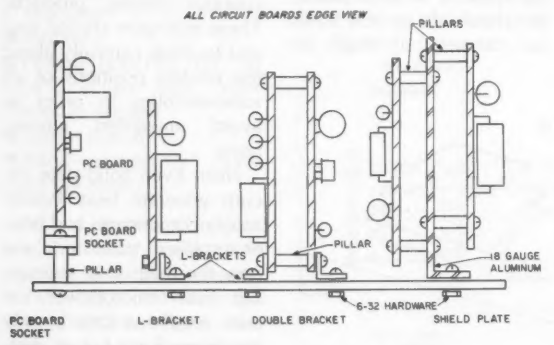

Fig. 8. Four methods of mounting circuit boards: PC-board sockets, L-brackets, double brackets, and shield plate.

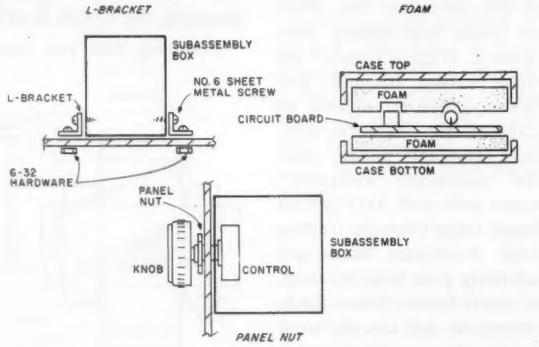

Fig. 9. Three methods of mounting subassemblies: L-brackets, panel nuts, and foam.

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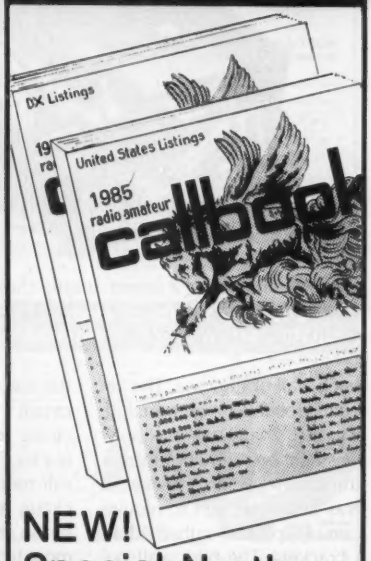

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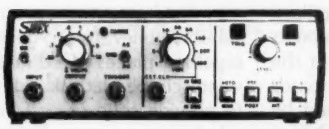

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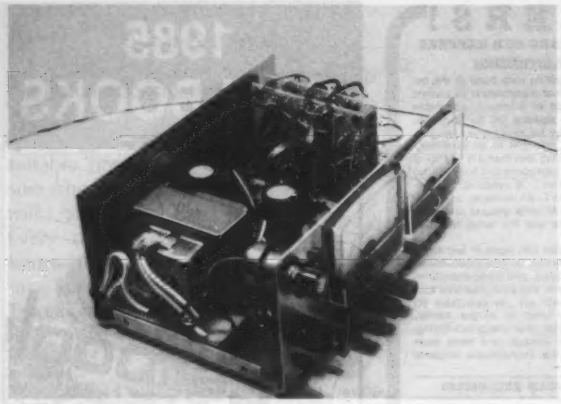

Photo C. Interior of a power supply showing two methods of circuit mounting: horizontal for heavy components and vertical for light control circuits.

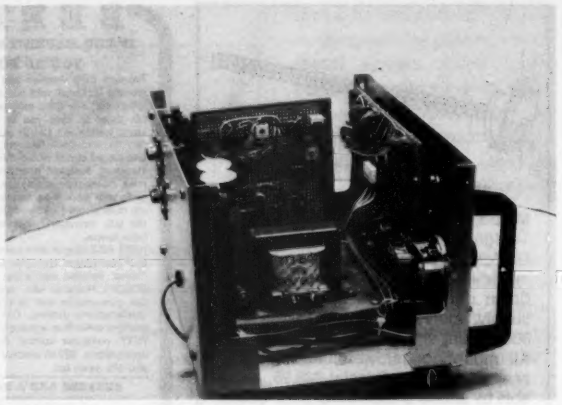

Photo H. A receiver filter using a combination of mounting methods: horizontal for the power supply, front-panel mount for a counter/readout circuit, and PC-board sockets for signal-processing circuits.

back wall of the case. The circuitry for this project, including the small power supply, was light enough not to stress the cabinet wall. However, it was heavy enough to require corner pillars rather than L-brackets. The back-wall position meant that there was no need to drill the bottom of the case. The position of the circuit makes removal for servicing or revision an easy matter. In addition, there is still room inside the case for circuit additions which might go on small boards vertically mounted to the cabinet bottom with L-brackets.

Photo G shows another combination of methods. The power components mount on a board supported by the cabinet bottom and pillars. The control circuitry mounts vertically at one end of the cabinet, with two boards back to back supported by four L-brackets. Each board dismounts independently for easy servicing. In Photo H, the still more complex receiver-filter project, we see even more methods at work. Again, the heavy power supply mounts horizontally in the middle of the case for weight balance. Against the front panel is a perfboard counter and LED circuit, mounted via standoffs to the threaded bezel mount. This system made a single unit out of an entire section of circuitry. The remaining circuits are on two experimenter boards that plug into PC card sockets mounted on pillars to the rear of the cabinet. (I removed one card to show the various subassemblies.) With this system, servicing and revising the circuits is simple. The plug-in cards pop out for work or to give roomy access to the remaining boards. The resulting project is still very open, allowing good air circulation and circuit isolation.

These illustrations do not exhaust the possibilities by any means. Rf circuitry, of course, will require more attention to shielding. This may lead you to construct subassemblies by soldering together pieces of double-sided copperclad board or to provide solid or perforated-aluminum covers for various parts of a project. Mechanical sensitivity may require the use of heavier materials for subassemblies, such as cast-aluminum boxes. In addition to the materials and hardware we usually associate with amateur radio, the world is full of things that may come in handy as insulating pillars, subassembly boxes, and a whole array of other helps around the shack. Among the items hams have used are cans (coffee, beer, and fish), plastic bottles, plastic parts from household items, bathroom products, packing materials, plumbing fixtures (both copper and plastic), and aluminum gutter. The possibilities are endless.

Providing a ham project with a cabinet and mounts is a task for both your imagination and your good sense. This article has looked at some of the good-sense basics of the matter. How much you improve upon them to make a better or more personal project is left to your imagination. ■

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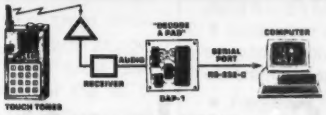

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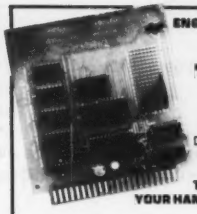

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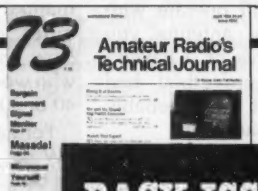

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It's the GRC-9: Still surprised?

The need for a low-cost rig for the new Novice—for Field Day or camping trips or just as a spare rig—has surfaced in the life of every ham. Here is an answer to all those needs and at a price you can't refuse!

The GRC-9 covers the upper portion of 160 meters, all of 80 and 40 meters, and the new 30-meter band. It will operate with almost any antenna you can conceive of. I haven't tried the proverbial bed springs, but they probably could be loaded up!

The rig will operate CW, MCW, and AM. The last two are sort of "who cares," but the CW is FB (up to 55 Watts input) with vfo or crystal, full break-in, high/low transmitter power, and receiver netting.

This rig was designed for the military for tactical communications over distances greater than can be covered by the usual handie-talkie or backpack FM gear commonly used. The manual specs up to 30 miles on ground wave. Now you show me a ham who works ground wave on 40 or 30 meters!

For ham use, it is really a CW rig, and not a bad one at that. It is complete in one package except for power supplies. The power input to transmitter will depend on the PA B-plus you use. The B-plus can be anything between 400 and 600 volts. The rig uses a 2E22 as a final. This is an instant-heating 807. The final is suppressor-grid modulated for AM and MCW.

Photos by Chris Wurtzinger

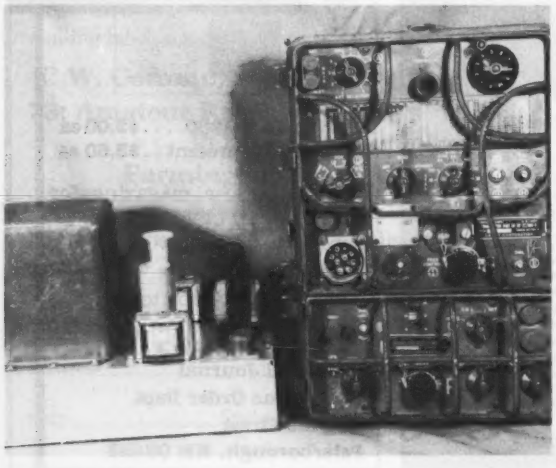

Photo A. The home-brew power supply is on the left. The GRC-9 is on the right.

The tube lineup for the transmitter is a 3A4 for vfo or crystal oscillator, a 3A4 doubler, and the 2E22 final. There is a vfo position and two crystal positions for each of the three ranges. There is also a 0C3 150-V regulator in the transmitter. It is used for both the transmitter and the receiver B-plus.

The receiver consists of a 1L4 rf, 1R5 mixer, 1L4 first i-f, 1R5 i-f/calibrator, 1S5 2nd detector first audio, 1R5 bfo, and a 3Q4 audio output.

The manual specs the receiver sensitivity at 2 microvolts for CW. I measured about 0.9 microvolts in the 80- and 40-meter bands for a 10-dB signal-to-noise ratio. The minimum detectable signal was approximately 0.15 microvolts (3-dB signal-to-noise ratio).

The receiver can be operated from batteries. The receiver requires a 90-volt B battery and 1.4 volts at 0.5 Amps; a no. 6 dry cell is recommended for the filaments.

I bought my rig from Fair Radio in Lima, Ohio, for a total of $60.00, which includes the rig ($39.95), the manual ($8.50), and the power connector ($4.00). The balance was UPS. The home-brew power supply I made came from the junk box, but Fair has a suitable power transformer and filter choke for about $10.00 total. The whole power supply shouldn't cost another $25.00. Now where can you get a 50-Watt, four-band CW portable(?) transceiver today for eighty-five bucks?

Powering the Rig

The military had several power supplies for powering the rig. First was the P.P. 237 vibrator supply for 6-, 12-, and 24-V-dc input; similarly there is the DY88 supply which also runs off 6, 12, or 24 V dc. The DY105 runs only on 24 V dc. P.P. 327 is the 120-V-ac supply and the neatest of all is the GN58. The GN58 is a hand-cranked generator which will power the rig at somewhat reduced power out. This really goes over great with the jr. ops when they are pressed into service on Field Day. (Mine was actually disappointed when I didn't buy one!) Only the GN48 was listed as avail-

able in the Fair Radio catalog.

None of the reasonable power supplies is available, so I home-brewed one. The schematic in Fig. 1 shows how simple it is. The supply will provide power for 12-V-dc portable operation and 120-V-ac operation in the shack.

For portable operation, the 12 volts for the filament regulator and relay supply come direct from the battery. The plate supply is powered from a 12-V-dc-to-120-V-ac 60-Hz inverter. The requirements are about 100 Watts total from the inverter. There are a number of camping inverters which will fill the bill. Another possibility is one of the little gasoline-engine-driven generators to provide 120 V ac for all the power requirements.

The power supply is shown in Photo A, next to the rig. No special precautions in building it are needed. The power transformer and filter choke are available from Fair Radio. However, any power transformer giving 600 to 900 V ac center-tapped at 200 mA, 6.3 V ac at 3 Amps or more, and 5 V at 3 Amps will serve admirably. The choke should be 8 to 12 henrys at 150 mA.

Using the specified transformer and choke, the outputs will be: B-plus final, +560 V @ 100 mA; B-plus (send), +105 V @ 50 mA; B-plus (standby), +105 V @ 20 mA; filament transmitter, +6.3 V dc @ 2 Amps; filament receiver, +1.4 V dc @ 0.5 Amps; relay, +6.3 V @ 0.5 Amps. *Note:* Only one 105-V requirement is used at one time; never both at once.

The "send" rating is for when the transmitter is working and the "standby" is for when only the receiver is on.

Construction is straightforward. The only adjustments are the voltage-regulator current-limiting resistors.

Before turning power on with the rig, check the power supply alone. Set R1, R2, and R3 for maximum resistance. This is very important or you will blow the tube filaments or the 0C3. The relay output should be about 12 V dc, no load. The transmitter filaments should read 6.3 if R4 potentiometer is set right. If you don't read 6.3 on the transmitter filament line, set R4 for a 6.3-V-dc output.

Connect the power supply to the GRC-9 and turn the supply on. Then set the control E to Standby. Plug a pair of phones into the receiver phone jack. This turns the receiver on. Measure the 1.4-volt line and adjust R3 for 1.4 V dc on this line.

Then adjust R1 for 20 mA through R1 with control E still in Standby. Now turn control E to Send. Check the 6.3-V-dc transmitter-filament output to make sure it is still 6.3 V. If it is not, carefully adjust R4 for 6.3-V output. Check the 1.4-V output again. It should read 1.4 to 1.5 V in both the Send and Standby positions of control E. Still in the Send position, adjust R2 for 50 mA through R2. This completes the power-supply adjustments.

At this point, attaching an antenna to the rig should permit receiving the ham bands and the 5-, 6-, and 9.5-MHz shortwave broadcast bands. This brings us to the next and perhaps the most important point—the antenna.

Antennas

As I mentioned, the rig has a built-in antenna-matching network. The circuit will match an endfed half-wave longwire, a sixteen-to-twenty-foot whip, or a half-wave dipole.

For longwires, a full half-wave-long conductor is endfed by the matching network when control A is in the Reel position. This is the second-best antenna configuration to use with this set, the dipole/doublet being the best. With the rig driving the high-impedance point on the antenna, the antenna current is low (voltage at feedpoint is high, however) and the ground losses in a poor ground system will be minimized. Most ground systems that can be put together for portable work are usually poor because of relatively high resistance. When driving a low-Z antenna, the I^2R losses are high in the ground system, thus wasting power.

The Whip position permits using an antenna 16 to 20 feet long against a good ground.

As I noted before, a low-resistance ground is neces-

Specifications

- **Frequency coverage 2–12 MHz in three bands:**

Band 1— 2.0 MHz to 3.6 MHz
Band 2— 3.6 MHz to 6.6 MHz
Band 3— 6.6 MHz to 12.4 MHz

- **Calibration marks are every 20 kHz on bands 1 and 2, and every 50 kHz on band 3 on the receiver dial and the transmitter calibration chart.**

- **Frequency Stability**

Transmitter frequency stability is ±0.02% for supply variations of ±10%. Nominal final input is 50 Watts with a 560-volt supply. Receiver stability is not spec'd, but varying the receiver B supply ±10% on CW did not take the signal beat note out of the audible range.

- **Transmitter Power Output**

Transmitter power-output switch at High and Low positions:
Mil Spec (High) 15 Watts CW, 7 W AM
(Low) 5 Watts CW, 1 W AM
Measured at 3.7 and 7.1 MHz into a 50-Ohm load:
(High) 28 W CW, 16 W AM
(Low) 9 W CW, 4 W AM

- **Receiver**

Sensitivity:
Mil Spec 2 uV CW, 10 uV AM
for 10-dB signal-to-noise ratio
Measured 0.9 uV CW (7 MHz), 3 uV (7 MHz) AM
0.8 uV CW (3.7 MHz), 3 uV (3.7 MHz) AM

- **Bandwidth**

	Mil Spec	Measured
6 dB down	3.5 kHz maximum	2.9 kHz
20 dB down	12 kHz	10 kHz
60 dB down	30 kHz	23 kHz

- **Calibration Accuracy**

The mil spec calls out ± one calibration mark on any band. I never found more than two fiducial line widths of error in the ham bands. The receiver has a "netting" capability to permit setting the transmitter frequency exactly to the signal being received. There also are separate volume and rf-gain controls, a bandswitch, and a dial-light push-button for lighting the dial lamp when necessary.

- **Power Requirements**

Transmitter:
B+ (final) 400 to 600 V dc @ 100 mA
B+ (MO & X2) 105 V dc @ 50 mA
Filament: 6.3 V dc @ 2 Amps regulated
Relay: 6.3 V dc @ 0.5 Amps
Receiver:
13+ 90 to 150 V dc @ 18 mA
Filaments: 1.4 V @ 0.5 A
Output Power: 90 mW @ 10% distortion
Output Impedance: 250 Ohms or 4k Ohms

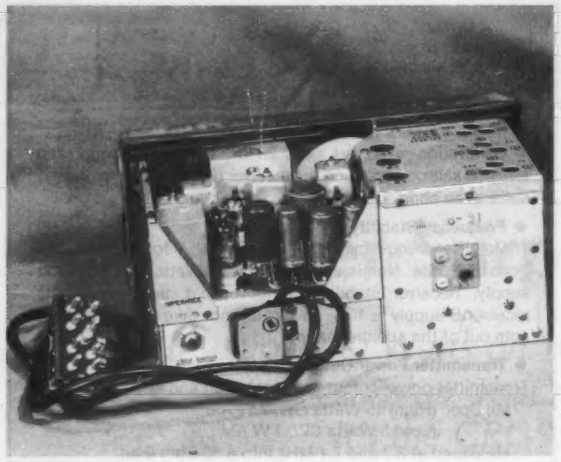

Photo B. Rear view of the receiver with tube shield off. Note output Z switch on left side of chassis.

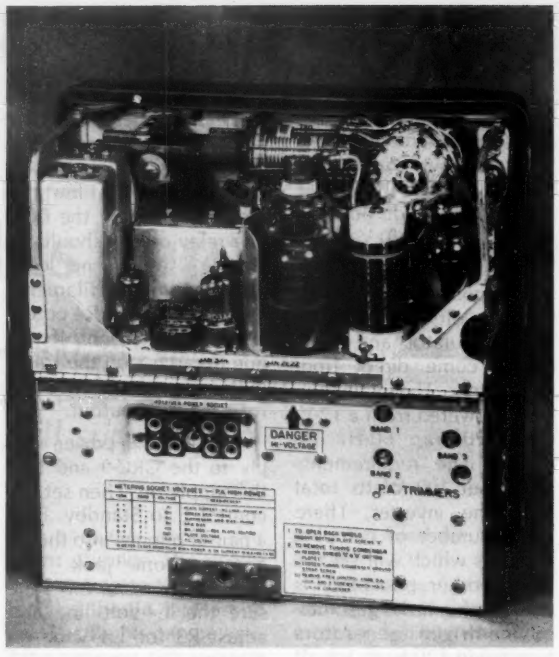

Photo C. Rear view of the transmitter showing location of crystal sockets. They are marked for band and A or B.

sary for satisfactory operation with a whip antenna. I would recommend at least six 30-foot radials laid on the ground with the ends attached to one- or two-foot ground rods driven into as moist a soil as you can find.

In the Doublet position, the matching network is designed to match a 50-to-70-Ohm balanced load. A half-wave doublet has a center-driving impedance of 72 Ohms when the antenna is more than a quarter wave above the ground. 72-Ohm twin lead can be used as the transmission line, or RG-59 (75-Ohm coax) can be used. If coax is used, the shield should go to the terminal marked "doublet" and a jumper should be put between this terminal and the ground terminal on the receiver panel.

Whatever the type of antenna chosen, place control A on the highest number of that type. For instance, whip-antenna loading should start at Whip 4 and work down to Whip 1. The Reel position is actually for the longwires. Here you start at 8 and work down to 5, and finally for doublets, you start at 11 and work down to 9.

The procedure for tuning should be as follows. Assume a doublet is to be used.

Set control A to 11 and vary control C between 1 and 10, setting it for the brightest indication of indicator B. Make sure the red dots are matched on the indicator bezel.

When using the longwire, it may be difficult to get a good indication. In this case, disconnect the antenna and quickly tune the matching network for maximum glow of indicator B. Then reconnect the antenna. *Do not* keep the transmitter keyed more than 15 seconds under the no-antenna condition, or damage will occur to the 2E22.

If a multiband vertical is to be used with the rig, use the Doublet position with RG-58 or RG-8 and the shield connected to "doublet" and "ground" connectors.

The matching network will make up for minor variations in antenna length. Recommended antenna lengths for the ham bands are shown in Fig. 4.

Receiver Operation

The receiver functions when the power supply is turned on and when the transmitter switch, control E, is placed as follows:

A. *Standby Position*. The

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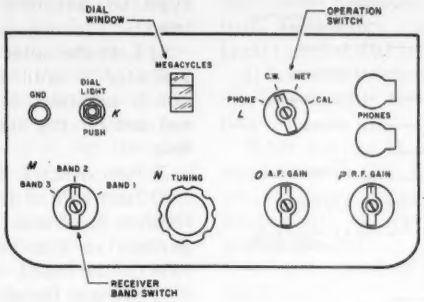

Fig. 1. Location and identification of receiver controls.

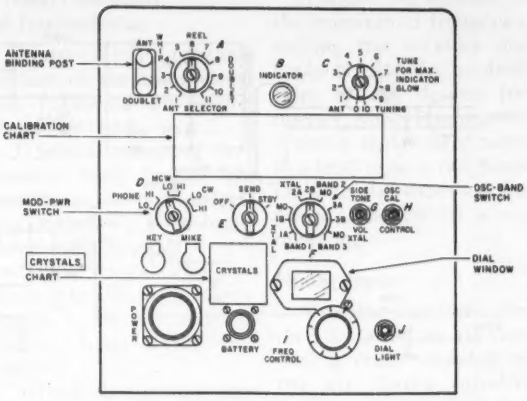

Fig. 2. Location and identification of transmitter controls.

Standby position is used when long periods of listening are required in order to reduce the wattage requirement from the power source.

B. *Send Position.* This position is used when the receiver is silenced and the transmitter is turned on when the key or the push-to-talk switch is pressed.

Preliminary starting procedure for receiver. Place operation switch control L as follows:

1) Phone. When receiving AM or MCW signals.

2) CW. When receiving CW signals.

3) Cal. When calibration of the receiver dial is desired.

4) Net. When aligning the transmitter frequency (control I) to the received signal for net operation. Also for aligning the MO (master oscillator) stage (control H) of the transmitter when the receiver dial is accurately calibrated.

Set bandswitch control M for the desired band of operation.

Turn af gain control O and rf gain control P to their maximum clockwise positions.

Turn on the switch of the power supply. Install the plug of the headset into the Phones jack of the receiver.

Prior to using the set, remove the receiver from the case and set the impedance switch located on the rear of the receiver section to the desired impedance, 250 Ohms or 4000 Ohms. Note: If the plug is not in the Phones jack, the filaments of the receiver tubes will not light.

C. Connect the antenna and a ground wire. Then set the antenna selector switch, control A on the transmitter, as shown in Fig. 5.

AM Reception.

Turn control L to Phone.

Turn control E on the transmitter to Send or Standby.

Turn controls O and P counterclockwise for a comfortable listening level in the headset.

CW Reception.

Turn control "L" to CW.

Tune for an audible beat note instead of a modulated signal. Adjust tuning for suitable beat note.

Receiver Calibration

This operation is used to check whether the dial reading for tuning control N actually gives the true frequency to which the receiver is tuned.

A 200-kHz crystal installed in the receiver supplies a series of crystal-controlled check frequencies against which to check the calibration of the receiver and transmitter. These check frequencies are all harmonics of 200 kHz. The calibration checkpoints are 2,000 kHz, 2,200 kHz, 2,400 kHz, and up to 12 MHz, thus covering the entire range of the radio set. To check the calibration of the receiver dial, proceed as follows:

1) Turn control L to Cal.

2) Turn control E on the transmitter to Standby.

3) Turn control D on the transmitter to Phone. In the Phone position, the filaments of all the transmitter tubes are not supplied with power and are inoperative unless the microphone push-button is pressed.

4) Turn af gain control O to the maximum or greatest clockwise position.

5) Turn rf gain control P to the maximum or greatest clockwise position.

6) Turn control M to band 3.

7) Turn tuning knob N to the lowest-frequency check (2.0 MHz). Adjust the tuning knob until zero beat is obtained on the strongest beat note in the vicinity of the crystal checkpoint. At this point, the dial should read close to the 2.0-MHz mark. Check in a similar fashion at a 200 kHz point near the desired receive frequency.

If interference from strong signals is being picked up during calibration, the antenna lead-in can be disconnected from the antenna binding post to avoid misleading beats.

Net Operation

The Net position of control L allows the transmitter to be tuned exactly to any frequency which the receiver is receiving. The Net position is used in conjunction with the transmitter when it is desired to place the transmitter in a group or net. To be sure that the transmitter is tuned to the same frequency as the receiver, proceed as follows:

1) Turn switch E to the Send position.

2) Receive the desired signal with the receiver tuning control L on CW.

3) Observe the frequency of the station and, referring to the transmitter-calibration chart, adjust the transmitter frequency control dial I to the approximate frequency.

4) Turn switch L on the receiver to the Net position.

5) Turn switch D on the transmitter to CW. Do not place switch D on Phone because it will be impossible to tune the transmitter to the receiver frequency.

6) Tune the transmitter frequency control I until the strongest beat note is heard in the headset.

7) Adjust frequency control I on the transmitter until a condition of zero beat is obtained.

Caution: During the entire process of tuning the transmitter to the receiver, do not press the key because this will cause the transmitter to have full output.

8) After the zero beat is found, lock the tuning

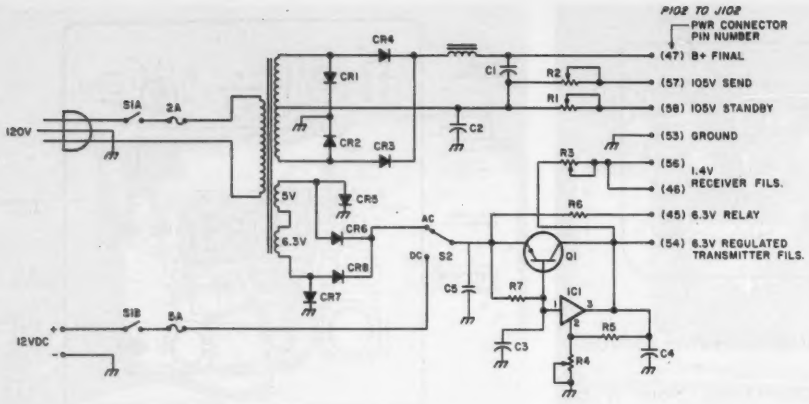

Fig. 3. Power-supply schematic.

knob of frequency control I.

9) Turn control D on the transmitter to CW.

10) Turn control L on the receiver to CW.

Transmitter Operation

The transmitter functions only when Off-Send-Standby control E (see Fig. 2) is in the Send position. When the key or microphone switch is closed, power is supplied to the transmitter and removed from the receiver.

Dial Reading. The tuning dial associated with frequency control I consists of two graduated scales. One is located behind a glass window and the other is marked around the edge of the tuning-control knob. The numbers on both of these scales are taken as one reading, and they determine the frequency to which the transmitter is tuned. The numbers are not the actual transmitting frequencies but are related to these frequencies by the calibration chart on the transmitter panel. *Do not operate* the transmitter without the antenna connected. Damage to power tube 2E22 will result.

Dial-Reading Calibration Chart. On the transmitter panel is a dial-reading calibration chart which relates the different frequencies of transmission to the dial settings. Each set must be tuned by the chart on its panel. Assume that it is desired to transmit on a frequency of 5,540 kHz in band 2; proceed as follows:

1) Find 5,500 kHz in the Freq. column of the band 2 section. Five columns, each with headings from +00 kHz to −80 kHz, follow this column.

2) Because the dial setting for 5,540 kHz is wanted, the +40-kHz column is the one referred to.

Band	Longwire	Doublet	Whip
160 m	240'	240'	20'
80 m	132'	132'	20'
40 m	65'	65'	20'
30 m	46'	46'	16'

Fig. 4. Recommended antenna lengths for the ham bands.

Control A Position	Ant. binding post connection	Gnd. Post
Whip 1, 2, 3, or 4	Ant.	Gnd.
Reel 5, 6, 7, or 8	Ant.	Gnd.
Doublet 9, 10, or 11	Ant. and Doublet	Not Used

Fig. 5. Antenna selector switch (control A) settings.

3) In the small box where lines through 5,500 kHz and +40 kHz intersect, the number 2284 is found. This is the number to which the dial should be set in order to transmit a frequency of 5,540 kHz—22 in the window and 84 on the knob skirt.

Vfo Operation

The oscillator section of the transmitter may be either crystal-controlled (Xtal position of control F) or a master oscillator (MO position of control F). The MO can tune over the entire band.

To transmit using the MO, proceed as follows:

1) Connect the antenna, key, microphone, power cable, and start-up set.

2) Set switch D to Phone, MCW, or CW, whichever type of transmission is desired.

3) Set control F to the MO position for the desired frequency band.

4) Release the lock on the frequency-control knob (control I). Turn control I to correspond with the transmitting frequency as shown on the calibration chart. If an unlisted frequency is used, interpolate to obtain the correct dial setting.

5) Turn antenna selector switch A to the highest numbered position for the type of antenna being used.

6) Turn the outer lens of indicator B until the red dot is adjacent to either red dot on the stationary lens.

7) Turn switch E to Send.

8) Turn control L on the receiver to Phone or CW position so that the sidetone can be heard.

9) Release the dial lock on antenna tuning control C. Press the button on the microphone, or close the key and rotate control C until indicator B glows at its maximum intensity. This indicates *resonance* or matching of the antenna to the transmitter.

10) If the indicator does not glow through a complete sweep of knob C, turn antenna selector knob A to the next lower number. Rotate knob C again until maximum glow is seen. If there is still no glow, repeat with knob A.

11) If the indicator glows with more than one setting of knob A, always use the highest-numbered position of this switch at which the indicator will glow. When using a longwire antenna, it is sometimes difficult to see any indication of resonance on indicator B when control C is tuned through resonance. In that case, temporarily remove the antenna lead from the antenna binding post and adjust control C to give maximum indicator glow, then reconnect the antenna lead and proceed with normal operation. When the antenna lead-in is reconnected, readjust control C for maximum brilliance, if necessary.

12) When the tuning procedure is completed, lock controls I and C in place.

13) Adjust sidetone volume control G for the desired volume level in the headset.

Transmitter Calibration

If it is desired to send a signal of approximately

3,800 kHz, set frequency control knob I at the appropriate setting as determined from the chart. When this setting is made, the calibration operation ensures that the transmitter will send a signal of 3,800 kHz. This is accomplished first by accurately calibrating the receiver, and then by feeding a reduced signal output of the transmitter into the receiver. The procedure is as follows:

1) Calibrate the receiver. The selected calibration frequency of the receiver must be a multiple of 200 kHz, which is closest to the desired signal output of the transmitter. Assume that a transmitter signal of 3,835 kHz is desired. The receiver should first be calibrated at 3,800 kHz because receiver calibration is accomplished by using the harmonics of a 200-kHz crystal.

2) Turn control F to MO for band 2.

3) From the transmitter calibration chart, determine the dial setting corresponding to the calibration-check frequency and turn frequency control knob I to that dial setting.

4) Turn control L on the receiver to the Net position.

5) Set control D on the transmitter to CW. Do not set it to Phone because calibration will be impossible in that position.

6) Turn control E to Send.

7) Turn af gain control O and rf gain control P on the receiver to their mid-position settings.

8) Adjust oscillator calibration control H on the transmitter with a screwdriver until a beat note heard in the headset stops and then starts again. The place where the silent point (zero beat) appears is where control H should be set. This corrects the calibration for that particular frequency, and all other frequencies within that band also will be correct.

9) To restore the receiver and transmitter to normal operation, turn control L to CW. Then set control I to the chart reading for 3,585 kHz.

Crystal Operation of Transmitter

To use crystals in the operation of the transmitter, the following procedure should be used:

1) Select operating frequency. *Note*: Crystal frequency is one-half operating frequency. Use only series-mode crystals.

2) Plug crystal into appropriate band sockets (band 1 for 40 and 30 meters, band 3 for 160 meters).

3) Look up operating frequency on calibration chart. Set frequency control I to the indicated dial reading.

4) Rotate control I above and below this setting while holding the key down and observe indicator B. The correct setting will correspond to the brightest glow of the indicator. Readjust control C again for maximum brightness of indicator.

The crystal-oscillator section of the transmitter may be checked for operation as follows:

1) Set receiver control L to Net.

2) Adjust the receiver to the transmitted frequency, rocking the receiver dial knob N slightly to both sides of the desired frequency while listening for a strong signal (beat note). If a beat note is not heard close to the expected frequency, the crystal is not operating.

Floobystones

After the first few contacts I started to ask how the rig really sounded on the air. Some reliable locals were worked and they critiqued the rig. The results were gratifying. The keying characteristics in the MO mode are quite good and no drift was measured over a half-hour operating time. All agreed that the rig is worth the money.

I look forward to the camping season when I can take the rig on weekend campouts.

Are there improvements I would like to make to the rig? Sure there are. First, I am building an active filter/amplifier module to improve receiver performance. The 3-kHz-receiver bandwidth is a little wide for good CW work. I am building a 600-Hz active filter which will be combined with a one-Watt audio amp to drive a speaker. This will help quite a bit. I have used these filters before and they really help things in a crowded CW band.

I am also looking at the possibility of making the first i-f regenerative and using it as a Q multiplier.

Considering the cost—$60.00 total—the conversion effort, building a power supply and cable, and the total time (about eight hours), this was one of the most successful surplus conversions I have ever made. I will be glad to answer any questions anyone may have if they write me at the address given and include a self-addressed stamped envelope. ■

Power-Supply Parts List

R1	10k-Ohm, 10-Watt adjustable wire-wound resistor	(Newark, #13F539—$3.12 ea.)
R2	3k-Ohm, 10-Watt adjustable wire-wound resistor	(Newark, #13F530—2.80 ea)
R3	10-Ohm, 5-Watt adjustable wire-wound resistor	(Newark, #13F505—2.69 ea.)
R4	500-Ohm, 2.5-Watt potentiometer	(Newark, #27F1116—1.87 ea.)
R5	330-Ohm, ½-Watt, 10%, fixed carbon-composition resistor	(Radio Shack—.49 ea.) (Newark, #13F147—1.27 ea.)
R6	12-Ohm, 5-Watt fixed wire-wound resistor	
R7	39-Ohm, 1-Watt, 10%, fixed carbon composition resistor	(Radio Shack—.49 ea.) (Newark, #13F147—1.27 ea.)
R8	20k-Ohm, 10-Watt fixed wire-wound resistor	(Newark, #13F147—1.97 ea.)
R9	40k-Ohm, 20-Watt fixed wire-wound resistor	
T1	Power transformer 810 V ac c-t @ 220 mA, 6.3 V ac @ 3 A, 5 V ac @ 3 A	(Fair Radio, #3252—9.95 ea.) (Newark, #18F235—5.40 ea.)
C1, 2	80-uF, 450-V-dc electrolytic capacitor	(Radio Shack—.37 ea.)
C3	0.1-uF, 50-V-dc ceramic capacitor	(Newark, #15F073—.42 ea.)
C4	2-uF, 15-V-dc electrolytic capacitor	(Newark, #18F2446—5.73 ea.)
C5	10,000-uF, 15-V-dc electrolytic capacitor	(Fair Radio, #228-1859—3.25 ea.)
CH1	10-henry choke	(Newark, #IN4007—.55 ea.)
CR1, 2, 3, 4	1N4007 1000-V-piv @ 1-A diodes	(Newark, #MR850—.55 ea.)
CR5, 6, 7, 8	MR850 50-V-piv @ 3-A diodes	(Newark, #MJ2955—1.06 ea.)
Q1	MJ2955 PNP power transistor	(Newark, #MC7805CK—2.21 ea.)
IC1	MC7805CK 5-volt IC regulator	

Fair Radio Sales Co., Inc.
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Lima OH 45802
(419)-223-2196

Newark Electronics
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Chicago IL 60625

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Brownsville TX 78520

The Texas Trans-Tester

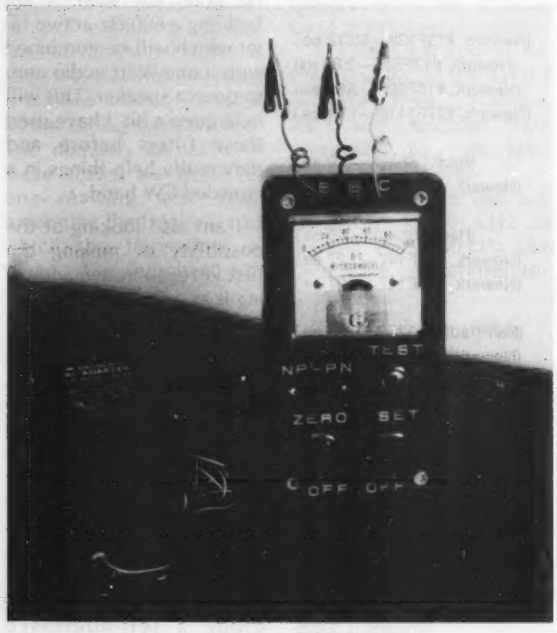
Here's how to measure small-signal gain with a transistor checker you've built from scratch.

One simple way that many of us use to test transistors is by means of an ohmmeter. Each junction is measured for forward and reverse resistance. These tests can detect if the junctions are open or shorted or if excessive leakage is occurring. In fact, it can be a useful check to identify the type of transistor, but it doesn't tell us much more.

I thought it would be nice to be able to measure transistor gain with a reasonable amount of certainty, so after reading up a bit on the subject I put together a little tester to measure the static beta, or h_{fe}—or what the experts call "the common-emitter static value of forward-current transfer ratio," or, more simply, the no-signal current gain of a grounded-emitter amplifier.

Despite the ominous sounding words, the required setup is very simple, as can be seen in Fig. 1. This did the job, but after a while I wanted something more accurate; the readings being obtained included the leakage current and therefore didn't tell me the real gain.

The schematic diagram in Fig. 2 shows what I finally worked out to measure the small-signal gain, or h_{fe}, also called the ac beta of the transistor. During this measurement, a collector current (which includes leakage current) is first established to simulate an operating condition, then the current is cancelled in the metering circuit and additional bias is applied; the meter now will show the current gain under those conditions.



A simple transistor checker.

Construction

The checker was built in a small plastic instrument cabinet (Radio Shack #270-222). There is absolutely nothing critical about the circuit. R1 is a 1-megohm linear pot to control or set the initial bias. R2 is a 2k-Ohm linear pot to zero the meter. Both these pots have switches, as shown in the diagram.

All the resistors are 1/4-Watt, 10 percent. Test switch SW3 is a normally-open push-on (Radio Shack #275-1547 or similar). For SW4, I used a common-variety DPDT slide switch (Radio Shack #275-407 or similar). The only expensive item is the meter. I happened to have a 1-7/8" × 1-5/8" 100-microamp size; I shunted it to measure 0-to-2 mA so that it would measure a maximum h_{fe} of 200. Some transistors may go out of scale, so a 0-3 or 0-4 might be a better choice. A more economical approach for those who have a multimeter might be to install a socket or binding post and use the outside meter.

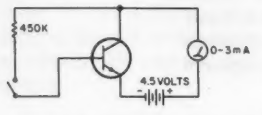


Fig. 1. Static beta measurement.

To power the tester, I use an ac adapter (Radio Shack #273-1454A) that provides 6 volts dc, but you could build your own power supply in the conventional way. Maybe a bigger cabinet can be used with a larger meter and a built-in power supply. Incidentally, I use the ac adapter to run a chess game when I am not checking transistors.

Using the Meter

Connect the transistor to the appropriate leads and set the slide switch to NPN or PNP, as the case may be, then turn SW1 on and set the meter to 1 mA. This is the initial bias. Now, turn SW2 on and with R2 set the meter to zero. To measure the h_{fe} gain, push the test switch. If the scale is in milliamps, multiply it by 100 to obtain the small signal current gain.

I have found this little

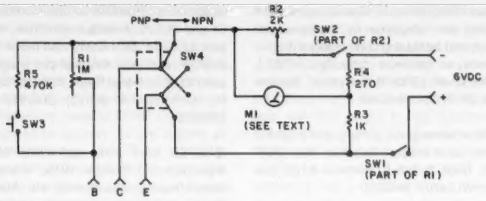


Fig. 2. Schematic diagram.

meter very useful, especially when trying to identify and evaluate hordes of transistors that have somehow found their way into my junk box. With the values shown, it will test or measure any small- or medium-signal bipolar transistor. It cannot be used to measure "power" transistors, although it will tell if they are still usable. It cannot tell up to what frequency the transistor will work, nor will it test FETs, JFETs, or MOSFETs, etc. For those tests, other circuits are required. ■

References

1. Solid State Servicing, RCA Institutes, Inc.
2. Transistor Manual, General Electric Company.

Parts List

R1 1-megohm linear potentiometer with switch
R2 2k linear potentiometer with switch
R3 1k, 1/4-Watt, 10% resistor
R4 270-Ohm, 1/4-Watt, 10% resistor
R5 470k-Ohm, 1/4-Watt, 10% resistor

See text for other parts.

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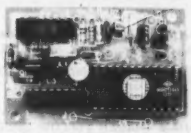

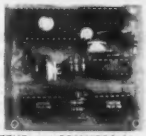

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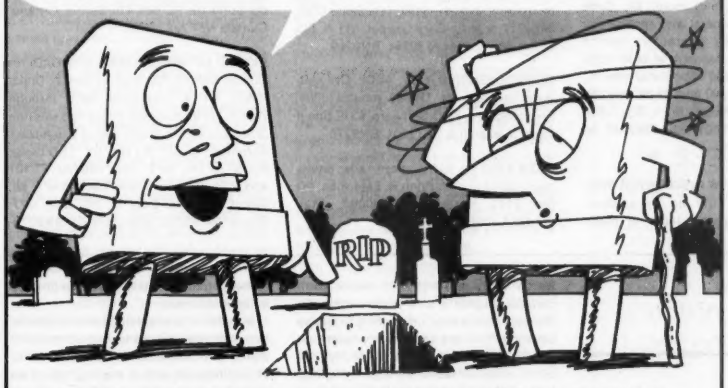

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LETTERS

SUN ANGLE

In my October, 1984, article, "When Darkness Calls," I asked whether anyone had information on the significance of the "widely used figure" of −.75 degrees for the angle of the sun relative to the horizon at sunrise or sunset.

I have the answer now from EA3VY, who seems to know just about everything there is to know on the subject. It is very simple: When the tip of the sun is peeping over the horizon, the *center* of the sun is 50 minutes of arc below the horizon (about .75 of a degree in decimal terms).

So now I enter −.75 rather than 0.

Bob Eldridge VE7BS
Pemberton BC

JOHN Q. HAMS

With the increasing tendency over the past few years by local government towards more restrictive antenna ordinances, coupled with a largely apathetic amateur community, I thought it would be beneficial to share with you my recent experience. My story is one where my own city's amateur-radio emergency group took no effort to assist another amateur in battling a restrictive antenna ordinance.

I recently moved to the city of Irvine, California. The city has a 35-foot height restriction on external antennas, and there are no CC & Rs that prohibit external antennas. I wanted to install a 55-foot crank-up tower and antenna. Since the tower would be lowered to a height of 24 feet when not in use, it would be more aesthetically appealing than a 35-foot free-standing tower. Since my antenna would exceed the 35-foot height limit, I was required to obtain a Conditional Use Permit, something that the city had never granted a ham before me.

In addition to supplying the city with detailed engineering plans, site survey, plot plans, environmental assessment, letter of justification, and a mailing list of all property owners within 300 feet of my QTH, the city charged me a $300 filing fee and $44/hour to review my plans and prepare a staff report to the Planning Commission.

While my application was being processed, I sent out a 4-page letter to 270 licensed hams in Irvine, advising them of my problem and asking for their attendance at my public hearing. My letter mentioned that I would be stressing the public-service aspects of amateur radio in my presentation to the Planning Commission, because the Planning Commission had to determine that my proposal was in

accord with the public health, safety, and welfare for them to grant approval.

I provided every ham with an SASE and a reply note to send back stating whether or not they could attend, as well as stating their support for my proposal. I received 50 letters back, most of which indicated a willingness to support me and appear at my public hearing.

Interestingly enough, the City of Irvine has a group of over 50 amateur-radio operators that voluntarily assist the Public Safety and Police Department (Irvine Disaster and Emergency Communications). This group voluntarily provides their time and equipment to assist the Public Safety Department in times of emergency and public events. This group attends regular monthly meetings at police headquarters and receives training in first aid, emergency preparedness, damage assessment, etc.

I am also a member in good standing of this group. In fact, two months ago I was asked to make a presentation to this group on fast-scan ATV, highlighting its potential application for the IDEC group. This presentation was very well received, and Hugh Davis W6YBI and I were asked to assist in setting up this mode for the group.

Out of the 50 response letters I got back from the hams in Irvine, only two came from IDEC members. A week before my public hearing with the Planning Commission, IDEC had its regular monthly meeting. I mentioned to the group my disappointment in not hearing from more IDEC members, especially since we as a group were involved in directly benefiting the city, and our public-service accomplishments should not go unrecognized. Several board members and members at large indicated that they were in fact planning on attending, but simply forgot to send me their reply. It is important to note that at no time did I ever ask the IDEC group to take an official position in support of my antenna, but only as individual hams involved with public service and sharing a common bond.

The night of my public hearing came on November 1, 1984. My partners in IDEC did not even have one person from the group show up. Unbelievable! However, almost 50 other John Q. Hams not involved with IDEC rallied to the cause. We put on an excellent presentation to the Planning Commission that highlighted what amateur radio was, and its outstanding track record of public service on a local, state, and federal level. The Planning Commission also reviewed a petition signed by 55 of my neighbors in opposition to me, as well as many letters from neighbors expressing their concern about my antenna.

When it was all said and done, the Planning Commission gave unanimous approval to my application. An unprecedented victory for the hams in Irvine. Many of my opposing neighbors made comment at the public hearing of the excellent presentation we had made. Several said that they had no idea that ham radio was involved in so many fine public-service activities.

Where were the IDEC people? Irvine's own public-service ham group, individually and collectively, miserably failed to help a member and fellow ham in time of need. What an excellent opportunity to demonstrate a value and a worth to the community. Were they afraid that the Planning Commission might realize that the IDEC group represented ugly antennas in Irvine and cut off the city's limited financial support to the group?

What if the city were considering an ordinance to ban rubber duckies from Irvine—would they have gotten off their butts and taken a stand, or just run scared?

What if IDEC's closed and unfriendly 2-meter-repeater site was being threatened by a restrictive antenna ordinance—would they have taken a stand then?

My hats go off to the 50 or so plain old average hams in Irvine and the surrounding areas that took the time to help me and sell ham radio to the community. Many of those people just sat at the public hearing in silent support for me, representing the amateur community. Their presence had a positive impact. What a sad commentary, however, the IDEC group is on the future of ham radio. The future will continue to hold restrictive antenna ordinances and spectrum threats, while the majority of ham radio sits back and watches our hobby disappear.

Herb Rosenberg N6KJL
Irvine CA

TOO SIMPLISTIC

73 is one of the amateur-radio magazines which I enjoy for its technical articles, and I would rate it tops in that category over several other amateur magazines which I read. It also provides me with some needed humor in its editorial section.

The no-code clash seems to be one of the things, like the phoenix, that keeps rising from the ashes. The opinion that a no-code license would rescue amateur radio from some perceived doldrums gets a lot of press, and I see that even Japan is cited as one of the places where electrical geniuses were developed because of a no-code license. In the recent controversy in the US, Canada's no-code license was cursed and praised and neither side ever exhibited the faintest glimmer that they knew one thing about the no-code license here.

. Citing the Japanese experience with a no-code license as some type of evidence that it will spur research is, at best, subject to great suspicion. The Japanese education system, the emphasis on commercial electronics as a professional field, and their cooperation between government and business in world market decisions contribute considerably more to their developments in electronics than a no-code license for a hobby. A no-code license has not brought about the type of electronic technology miracle that seems to be expected in Canada, not to mention the USSR, where a no-code license has been in effect for some time. If I can rely on some of my friends in the education administration in the US, the quality of teachers that are now coming into the field (which has had a decline in prestige and pay) will not enhance the electronics education of the US children.

In a technical sense, the type of communications envisioned by the no-code advocates would require that amateur-radio candidates should have to pass a test in computer programming in order to operate the gear to decode and encode all that high-tech, high-speed (and high-priced) equipment that we should be using.

If I went deer hunting with all the technical equipment for locating deer—laser sights and heaven knows what else, I suspect that most people would think that I should just buy a beef cow and provide meat without all the fuss. Amateur radio, like hunting, should not be an obsession rather than a hobby. Bluntly put, the commercial equipment now used for communication far exceeds the pocketbook of amateurs and is much more certain than the chance communication on the amateur bands. Amateur contribution to this field which operates on a very expensive

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scale is not going to be much, despite what propagandists from the amateur community may say to the contrary. Trying to convince governments that we will make some significant contribution if the rules are changed will simply not work, because those changes will not produce the promised results. The fact remains that amateur radio is a hobby, and, like all hobbies, it is meant to be enjoyed rather than be used as a commercial experimentation expedition.

Whether or not there is a no-code license doesn't really concern me, to put it bluntly. However, my reaction to the advocates of no-code as a means of increasing members in the amateur-radio ranks and bringing about some technical revolution is one of great suspicion. If anyone thinks that a no-code license will bring about something that the educational, commercial, and professional systems have not brought about, their thinking is too simplistic to have any credence. In a world where simplistic solutions abound (like collectivization of farms solving the agricultural problem or sending more weapons bringing peace to Central America), another simplistic solution to a problem does not amuse me, and I am certain that I am not alone in this matter. In fact, if I could draw a nasty comparison, the no-code CB experience did not bring about any such revolution in electronic development, and I see no reason to believe that it will do so in the amateur ranks.

Undoubtedly, this letter will evoke some irate responses and to those who respond I put this question: Wouldn't basketball be more fun if the hoop was only two meters high? Wouldn't golf be great if the fairways were 50 meters long and the cups a meter wide? Wasn't CB fun? Would we get better basketball players and golfers, and the CB operators, not burdened by code requirements, should be whizzes compared to us strapped practitioners of the amateur-radio hobby. And, for that matter, if people have trouble with code and want the requirement dropped, then say so directly and don't beat around the bush. Saying that code is obsolete is like saying that bows and arrows are obsolete or that horses are obsolete or that radio is obsolete, for that matter. Of course they are. But they are still here, still used, and still enjoyed. Granted, the owner of Seattle Slew may be a bit offended if he found that his obsolete mode of transportation (for which he probably paid more for than a jet plane) could be beaten by any car on the road these days, but please... let him enjoy his hobby in peace, and let us enjoy our hobby in peace, too.

Finally, I enjoyed the comment about knowing ancient Hebrew to precede receiving a bible. My knowledge of Old Russian and reading of the documents from the 9th century in that area have given me a considerably better understanding of contemporary problems and, in fact, of the culture and mentality of the present Eastern European scene. It was a pain to learn, but it beats any translation, and the present translations are colored by the comments of the present political regime.

So, there it is... no-code or no no-code, who cares? But if you want more technicians, engineers, and other people in the electronics field, don't think that a no-code license is going to produce what lack of training, teaching, and financial inducements have now produced because, like Bismark so nicely put it, "Blessed are those who expect nothing, for they shall not be disappointed."

Francis Salter VE3MGY
London, Ontario

INVOLVED

I was twelve years old when I first learned about ham radio. I'm also female. I hear that I am a rare case. I finally got my license when I was 18 (two years ago). No one in my family is or ever has been a ham. I was different than the others when I was growing up. I liked radios and electronics (still do) and am now working toward my electronics degree.

I'm a new ham, but I don't have much money. A friend got a repeater set up on 220 MHz and I got some money together to buy a 220 radio, but now they're going to take the band away because no-code did not make it.

If I knew what was really going on instead of listening to the old-timers that swear by Morse code, I would have fought for no-code, like some other hams I know who weren't blinded by the old-timers. I am sure there are some other beneficial things that we fight against because we don't know the truth. We've got to learn the truth before it is too late. I hope it isn't too late.

Hams, myself included, are killing amateur radio. We must stop. We must work with the FCC. It can't be too late. I'm a young ham and I want to have the opportunity to enjoy amateur radio as you did—to learn and grow from it.

I would like to help save ham radio. I'm sure most hams would. Kids nowadays are interested, but they need a little push. If they *are* enthused and interested, most hams don't really help them. Example: A kid about 12-14 years old is watching a neighbor (Mr. Smith) who is a big ham operator. The kid is obviously interested, so Mr. Smith says, "Are you interested in all this?" The kid busts out a smiling, "Yes." "Well, if you want to get your license," Smith says, "all you have to do (pulling out a Novice book and a piece of paper with the code on it) is to study this book and learn the Morse code on this paper." He hands the kid the book and the paper. From then on, the kid is on his own until the kid is ready for his test.

Mr. Smith should have gotten *involved*—helped the kid with the code, practiced with him, and maybe even bought him a cheap code practice oscillator. I mean, if he can afford all that radio equipment, he can afford that. He should give the kid some of this time, help him become a ham, and teach him what amateur radio can mean to him. To leave the kid on his own with a book and a copy of the code is no help at all.

Make an effort for the kid, for yourself, and for amateur radio. It's up to us to keep it alive. Let's show the FCC that we still care and that we appreciate them for what they have done. We have to stop fighting. We have to come toghether and fight to put amateur radio back on its feet and make it what it was meant to be.

Karen A. Cooley KA6TRP
Sacramento CA

Karen—Thanks for the nice letter—you have a helpful suggestion for the old-timers. I sure appreciate your interest—particularly since you're a woman—we have all too few women in amateur radio who have a real interest in the technical end of things.—Wayne.

SUPERSTITIONS

Living in a community that does not allow outdoor antennas or even antennas disguised as flagpoles, I am always intrigued by solutions that provide some degree of radiating efficiencies particularly on the HF bands.

I don't have any magic solution, but getting away from the typical ham folklore and superstitions is a beginning to making the best of a bad situation. Discussions in the October, 1984, issue on the "Isotron" prompted this letter, but I'd like to cover a little more ground than that.

I don't know the "Isotron," but I know its physical dimensions from the discussion. As a trained professional in matters of physics, I immediately knew that its radiation resistance is quite low, which is not necessarily fatal, so I read on, looking for its bandwidth. As it turns out, its bandwidth was quoted as covering the band. That is bad in terms of radiating efficiencies. An efficient small antenna (compared to wavelength) must have a *small* bandwidth that decreases rapidly with decreasing physical size.

Here are some more useful things to remember about antennas in physically restricted space. Many of these ground rules go against conventional "ham" wisdom:

1) Make them as large as possible (to keep radiation resistance high). Loading coils do not count, they are just matching devices. If the vswr bandwidth is low, rejoice. Use a large-diameter cable to feed it. If the vswr is 5:1 at the band edge through the cable, rejoice again: You are probably not losing much power in the cable. If you want to know how efficient your cable is, measure vswr at the antenna and again at

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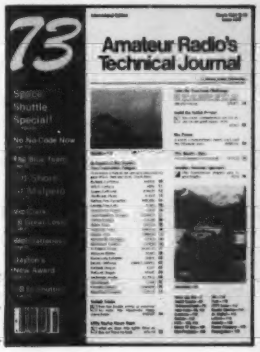

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the cable input. No *change* in vswr means no cable loss. Now use a good (physically large,) to get high Q) tuner.

2) If you want to compare two antennas, you don't have to go on the air. You will be better off not to. Just make sure both antennas are matched to roughly the same impedance. The antenna that receives better will also be heard better, *always*. This is a result of the linear bilateral nature of a communications circuit. The difficulty with "on the air" comparisons is that the two antennas are usually in two separate locations or have different patterns resulting in different fading cycles. In order to get a good evaluation of the difference, it takes more than one or two switchovers.

3) There is no such thing as "capture area" of an antenna as distinct from its performance in the radiating mode. An antenna system's performance is uniquely described by its gain over a reference radiator (dipole or isotropic). Unfortunately, physically small antennas of 1/8 to 1/20 of a wavelength such as are used for mobile or restricted-space service will have losses between 3 and 20 dB, depending primarily on length and secondarily on Q. Anything smaller will have even greater losses.

Peter Laakmann WB6IOM
Laguna Niguel CA

SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine *by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices,* 73 Magazine, *Pine St., Peterborough NH 03458.*

HOUGHTON MI
JAN 29-FEB 5

The Michigan Technological University Amateur Radio Club and the Copper Country Radio Amateur Association announces a radio celebration of our winter carnival festivities in the northernmost part of Michigan's Upper Peninsula. A certificate will be issued to all amateurs who make one contact with any participating ham in Copper Country between 0000 UTC January 29, 1985, and 0000 UTC February 5, 1985. Frequencies are 3.630, 7.090, and 14.095 RTTY; 3.705, 7.085, 7.125, 14.085, 21.085, and 28.185 CW; 3.930, 7.285, 14.305, 21.385, and 28.500 phone. (On CW, listen for CQ WC.) Send your QSL and $1.00 to cover postage and handling to Howard Junkin N8FHF, 106 W. South Avenue, Houghton MI 49931.

TRAVERSE CITY MI
FEB 9

The Cherryland Amateur Radio Club will hold its twelfth annual Swap 'N' Shop on February 9, 1985, from 9:00 am to 2:30 pm, at the Immaculate Conception Middle School gymnasium, 218 Vine Street, Traverse City MI. Admission is $2.50 and single tables are $3.00. Talk-in on 146.85 and 146.52 simplex. For further information, send an SASE to Paul Nepote KA8HIB, Chairman, 802 Fern Street, Traverse City MI 49684.

INVERNESS FL
FEB 9

The Sky High Amateur Radio Club will sponsor the Citrus County Hamfest on February 9, 1985, from 9:00 am to 5:00 pm, in the Citrus County Auditorium, 1 mile due south of Inverness FL on US 41. The ticket donation is $1.50 in advance and $2.50 at the door. Tables are $5.00. Talk-in on 146.355/.955 (W4IIR). For tickets, tables, or more information, contact SHARC, PO Box 2543, Homosassa Springs FL 32647.

MANSFIELD OH
FEB 10

The 24th annual Mansfield Midwinter Hamfest/Auction will be held on Sunday, February 10, 1985, beginning at 8:00 am, at the Richland County Fairgrounds, Mansfield OH. Tickets are $3.00 in advance and $4.00 at the door. Tables are $5.00 in advance and $6.00 at the door. Half tables are available. There will be an auction and flea market in large, modern, heated buildings. An ARRL/VEC license exam will be held at the Mansfield Campus of the Ohio State University/North Central Technical College (less than two miles from the hamfest) at 1:00 pm on the day of the hamfest. To take the exam, send an SASE, a 610 form, and a check for $4.00 payable to ARRL/VEC to Lloyd Nelson N8BAZ, 630 Oak Street, Lot 82, Mansfield OH 44907. Talk-in on 146.34/.94. For additional information or advance tickets or tables, send an SASE to Dean Wrasse KB8MG, 1094 Beal Road, Mansfield OH 44905, or phone (419)-589-2415.

ARLINGTON TX
FEB 16

The Texas VHF-FM Society will hold its annual winter convention, Wintercom' 85, on February 16, 1985, at the Charlie Club, 117 South Watson Rd., Arlington, Texas (between Dallas and Fort Worth). The proposed 20-kHz band plan for two meters will be decided at the convention. Also on the agenda are emergency communications by packet radio, common antenna systems, AMSAT, ATV, and 20-kHz repeater channel spacing. Tickets are $7.00 at the door. Hardin Electronics will move their "third Saturday flea market" to the convention (indoors). For further information, write Wintercom' 85, PO Box 3608, Arlington TX 76101-0408.

MARLBORO MA
FEB 17

The Algonquin ARC will hold its annual electronics flea market on February 17, 1985, at Marlboro Junior High School Cafeteria. Doors will open for sellers' setups at 8:30 am and to the public at 10:00 am. General admission is $1.00; sellers' tables are $7.50 in advance (before February 9th) and $10.00 at the door. Food will be available. Talk-in on .01/.61 and .52. For table reservations or more information, write to AARC, PO Box 258, Marlboro MA 01752.

MELVILLE NY
FEB 17

The Long Island Mobile Amateur Radio Club (LIMARC) will hold an ARRL-sponsored hamfest on Sunday, February 17, 1985, from 9:00 am to 4:00 pm, at the Electrician's Hall, 41 Pine Lawn Road, Melville NY (1/4 mile east and 1/10th mile north of Exit 49 of the Long Island Expressway). General admission is $3.00 per person (no exceptions); unfortunately, table space has been sold out. Features will include a VHF checkup clinic, food, refreshments, and free parking at the hall and alongside LIE. Talk-in on 146.25/.85. For more information, contact Hank Wener WB2ALW at (516)-484-4322, nights only.

GLASGOW KY
FEB 23

The annual Glasgow Swapfest will be held on Saturday, February 23, 1985, beginning at 8:00 am CST, at the Glasgow Flea Market Building, 2 miles south of Glasgow, just off Highway 31E. Admission is $2.00 per person and there is no additional charge for exhibitors. The first table per exhibitor will be free, and extra tables will be available for $3.00 each. There will be a large heated building, free parking, free coffee, and a large flea market. Talk-in on 146.34/.94 (primary) or 147.63/.03 (alternate). For additional information, write Mike Goad N4HCO, Rt. #4, Box 354, Glasgow KY 42141.

FRIDLEY MN
FEB 23

The Robbinsdale Amateur Radio Club will hold the 4th annual Midwinter Madness Hobby Electronics Show on Febru-

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ary 23, 1985, at Totino-Grace High School, 1350 Gardena Avenue NE, Fridley MN (suburb of Minneapolis). Admission is $4.00 at the door. The flea market will be open at 8:00 am and the retail exhibits will open from 9:00 am until 2:00 pm. Features will include manufacturers, dealers, and a flea market consisting of radio, computer, and satellite-TV gear. All FCC amateur-radio tests will be given. For more details, write Elmo Nygard, 4151 Adair Avenue N., Robbinsdale MN 55422. Talk-in on 147.60/.00 (K9LTC repeater) and 146.52 simplex. For more information, contact Robbinsdale ARC, PO Box 22613, Robbinsdale MN 55422, or call Bob at (612)-533-7354.

SALEM OR
FEB 23

The 1985 Salem Mini-Hamfair will be held on February 23, 1985, beginning at 9:00 am, at the Polk County Fairgrounds. Admission is $4.00. Now in its fifth season, the one-day event will feature seminars, commercial displays, amateur license exams, and a large flea market (set-ups begin at 8:00 am). Talk-in on 146.26/.86 and 146.52 MHz. For further information, contact Salem Repeater Association, PO Box 784, Salem OR 97308.

LIVONIA MI
FEB 24

The Livonia Amateur Radio Club will hold its 15th annual LARC Swap 'n' Shop on Sunday, February 24, 1985, from 8:00 am to 4:00 pm, at Churchill High School in Livonia MI. There will be plenty of tables, refreshments, and free parking. Reserved table space (12-foot minimum) is available. Talk-in on 144.75/5.35 and .52. For further information, send an SASE (4" × 9") to Neil Coffin WA8GWL, c/o the Livonia Amateur Radio Club, PO Box 2111, Livonia MI 48151.

DAVENPORT IA
FEB 24

The Davenport Radio Amateur Club will hold its 14th annual hamfest on Sunday, February 24, 1985, from 8:00 am to 4:00 pm, at the Davenport Masonic Temple, Highway 61 (Brady Street) and 7th, Davenport IA. Tickets are $2.00 in advance and $3.00 at the door. Tables are $7.00 each and for an ac hookup, an additional $2.00 will be charged. Talk-in on 146.28/.88 (W9BXR repeater). For table reservations and advance tickets, contact Dave Johannsen WB9FBP, 2131 Myrtle Street, Davenport IA 52804.

VIENNA VA
FEB 24

The Vienna Wireless Society will hold its annual Winterfest™ on Sunday, February 24, 1985, beginning at 8:00 am, at the Vienna Community Center, 120 Cherry Street, Vienna VA. Admission is $4.00. Coffee and food will be available all day. Talk-in on 146.31/.91 (NVFMA), 146.085/.685 (VWS), and 147.51 simplex. For vendor and tailgate applications, send an SASE to Earl Hohbein N4FSW, 4602 Lawn Court, Fairfax VA 22032. For further information, write to the Vienna Wireless Society, PO Box 418, Vienna VA 22180.

LAPORTE IN
FEB 24

The LaPorte ARC will hold its winter hamfest on Sunday, February 24, 1985, at the LaPorte Civic Auditorium, LaPorte IN (50 miles SE of Chicago). Donations are $2.50 each at the gate. Tables are $2.00 in advance and $2.50 at the door. (Reservations will be held until 8:30 CST.) There will be good food and plenty of room. Talk-in on .52 simplex. For more information and reservations, contact LARC, PO Box 30, LaPorte IN 46350.

BLACKSBURG VA
MAR 14-16

Virginia Polytechnic Institute and State University will hold a workshop, Personal Computer and STD Computer Interfacing for Scientific Instrument Automation, on March 14-16, 1985, at Virginia Tech, Blacksburg VA. The hands-on workshop, directed by Mr. David E. Larsen and Dr. Paul E. Field, is $450.00 for three days. Participants will be wiring and testing interfaces. For more information, write Dr. Linda Leffel, CEC, Virginia Tech, Blacksburg VA 24061, or phone (703)-961-4848.

150TH ANNIVERSARY
SPECIAL EVENT
VICTORIA, AUSTRALIA

A special commemorative callsign, VI3WI, part of the 150th anniversary celebration of the European settlement in Victoria, will be on the DX bands until at least April 30, 1985. VI3WI will be activated on a roster basis by selected members of the Wireless Institute of Australia and its affiliated clubs. All DX bands and all modes will be used and a commemorative QSL is available, either direct or via the VK3 QSL Bureau. A special award certificate is also available for radio contact with Victoria between November, 1984, and April 30, 1985. Contact (SWLs log) one station in VK3 during the award period to qualify. A QSL card for the qualifying contact, endorsed with a congratulatory message on Victoria's 150th anniversary, plus $2.00 or equivalent, should be sent to Victoria 150 Award, Wireless Institute of Australia, 412 Brunswick Street, Fitzroy 3065, Victoria, Australia.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 6

Even the Boy Scouts have dumped the code.

The sound defeat of the no-code proposal before the FCC last year by the ARRL yes-men ham clubs could be the beginning of the end for our great hobby. As it said in the article, "most of the students look upon it as a form of punishment" according to a teacher at a Navy school which still teaches a few people the code each year. Very few.

Once the FCC has acted on a proposal, it is difficult to get them to ever go back and reconsider it again. But look, if you will write a petition to the FCC recommending reconsideration of the no-code proposals—or even better, pass a petition around your ham club and at hamfests asking the FCC to reconsider—it's possible that we may get them to work with us again. Yes, I know they're absolutely disgusted with us for fighting progress and being so reactionary. They're rightfully furious with us for sealing our own doom. But this is a democracy, so no matter how much they think we're wrong, they've gone along with what you forced the ARRL to recommend and killed no-code.

If you will, please send me a copy of your petition so I'll be able to take it to Washington and make sure that every one of the FCC Commissioners sees it personally.

It's simple to petition the FCC. You write a letter in your own words asking for the reconsideration of the no-code amateur-radio license. You sign the letter, have it notarized, and send it to the Secretary, FCC, Washington DC 20554—and don't forget a copy to Wayne Green W2NSD/1, 202N, Peterborough NH 03458.

And don't forget March 24th—Ham-Day!

HAM HELP

I am looking for information on the use and modification of the General Radio 1606 rf impedance bridge.

George Churpek N6FL
839 Cambon Circle
Ojai CA 93203

Does anyone know of a modification that can be made to the Kenwood TR-7500 that will enable it to be used on the entire 2-meter amateur band? Any help will be appreciated, and I will pay any copying costs involved.

Dave Stepnowski KC3AM
735 W. Birchtree Lane
Claymont DE 19703

I need a copy of the schematic and manual for an EICO model 460 oscilloscope. I will gladly pay copying and postage costs.

Norman L. Duff
1505 South 25th St.
Lincoln NE 68502

Our small repeater group is in need of information on the Phelps-Dodge Super Stationmaster antenna (142-151 MHz). Specs and adjustment information is needed. Will pay costs and postage.

Lincoln County Repeater Group
R. L. Fredrick W7KCP
Box 154
Reardan WA 99029

Would someone please help me find schematics or information on how to obtain a remote-keyboard control for the ICOM 720A? I will gladly pay for any costs incurred.

Werner Heyen DL5BBD
Isdobben 3
2972 Borkum
West Germany

I need a schematic diagram for the Sinclair ZX-80. I will gladly pay for postage and copying.

Brian Iehl KA9MQE
4213 N. Ridgeway
Chicago IL 60618

Does anybody have information on how to build a ferrite-bead antenna?

Marvin Rosen N3BQA
20 W. Madison Street
Baltimore MD 21201
(301)-685-6308

Does anyone have the mailing address for Communications Company in Coral Gables, Florida? There is no listing for them in the current phone book. I have one of their 450-MHz repeaters and want to obtain schematics. Can anyone help with an address or, better yet, schematics I may copy?

Terry Simonds WB4FXD
PO Box 1558
Edgartown MA 02539

I would like to get in touch with DX stations interested in participating in a propagation study during the low end of the sunspot cycle by operating a CW beacon on 10, 21, or 28 MHz.

John Mahagan WB4JHS
PO Box 3282
Thomasville GA 31799

I need a manual, schematic, or calibration information for a Radiokit Arkay model 012 VTVM, and a manual or schematic for an Electronic Measurements Corp. model 101B VOM. I will gladly pay any copying and postage costs.

Robert Saltiel N2ETL
2190 Boston Rd.
Bronx NY 10462

HAM HELP

I need to get the Lafayette Variac (variable voltage control), new or used, number 99-60287 or similar, output from 0 to 140 V, 50/60 Hz, 500 W or higher, 117 VAC.

Mr. Salles
141 NE 3rd Ave. Suite 1110
Miami FL 33132

I am trying to locate a schematic or info on a Bullet 16-Amp, 12-volt power supply. Also, I am trying to locate Jerrold QDMX tower sections 6, 7, 8, and base stubs. Any info is appreciated.

P. E. "Packy" Pickrell AE3O
5028 Sidney Rd.
Mt. Airy MD 21771
(301)-831-5501

I am a high school student and would appreciate any donation of amateur radio equipment, working or not.

Mark A. James KB4FFC
6151 22 Ave. SW
Naples FL 33999
(813)-455-1385

I have an SBE SSTV rig that is ill—it needs a uA7090. Can anyone help?

R. F. Bricker K4CSV
PO Box 295
Fort White FL 32038

I am compiling data on VHF/UHF rf chokes. Can anyone send info on the Ohmite Z-235 and Z-460, or the Miller RFC-220 and RFC-420? I need the following: approximate wire size, length of winding, approximate number of turns, and the outer diameter of the form.

G. C. La Grange W5AKQ
318 E. Circle Drive
Baytown TX 77521

Does anyone know the wire lengths required for the Savoy-Bassett vacuum-trap antenna system, model DGA-4075, for 40 and 75 meters?

Ladd W2KQV
767 Lomas St.
Port St. Lucie FL 33452

I'm looking for information on the Realistic DX-302 shortwave receiver imported by Radio Shack in 1982. Does anyone know of a source for this radio? A used one would be suitable.

Sgt. Neal Roberts
11912 Amerado Blvd.
Omaha NE 68123

I need the schematic and manual for the Conar model 452 2-meter radio that was supplied with the old NRI ham-radio course. I will gladly pay any reasonable cost incurred.

Tom Ciciora KA8QPN
321 Pulaski Rd.
Calumet City IL 60409

I need help with a Radi Kilowatt model 401 electronic memory keyer. Either schematics, service info, or present location of the manufacturer. Glad to pay.

D. W. Langston W5BBV
PO Box 890
Salem AR72576

I need schematics and data for the Synthacoder 22S and the AED scanner for the IC-22S. I will copy these and reimburse your postage.

Bob Miller KC2VP
15 Crestwood Drive
Clifton Park NY 12065

NOTICE

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SG-2/ARN AIRCRAFT GLIDE-SLOPE SIGNAL GENERATOR 329.3 TO 335 MHZ IF FREQ 15 to 30 MHZ. METERED OUTPUT .1 V to 2 V MODULATIONS VARIABLE 0-100% 90 to 150 HZ. SAME AS BOONTON 232A 245.00

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UG-255 (PL-259 to BNC) $2.95
Elbow (M359) $1.79
F59A (TV type) ..... 10/$2.15
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⌐ See List of Advertisers on page 80

NEW PRODUCTS

COMMUNICATIONS DISCOUNT DIRECTORY

A new directory designed to help consumers buy communications equipment at the best possible prices has just been published by Di$count America Publications. *The Directory of Communications Equipment Discounters* lists mail-order companies that offer savings of up to 50% on video equipment, telephones, cameras, ham radios, televisions, copiers, and movie paraphernalia. For each listed company the address, telephone number, shipping policy, catalog cost (most are free), and payment methods are given, along with a paragraph describing what goods the firm sells plus samples of prices and discounts.

For further details, contact *Di$count America Publications, 51 East 42nd St., Room 417T, New York NY 10017.* Reader Service number 482.

HIDDEN TV SIGNALS

Universal Electronics announces their new book for the satellite trade. "The Hidden Signals on Satellite TV" is the first book that completely covers the entire field of non-video satellite services carried on the domestic satellites.

These services include: stereo subcarriers, telephone channels, world news and press services, Teletext and other VBI systems, single-channel-per-carrier (SCPC) systems, plus other data systems.

"Hidden Signals" deals with all phases of this expanding side of the satellite business: the systems, how they work, who uses them, how they are received, and how the services can be utilized. The entire book is devoted to this area, and will enable a person to thoroughly understand the latest developments and put this knowledge to use.

The 180-page book is straightforward, easy to read and to understand, and contains many diagrams, photos, and other pertinent information.

For additional information, write or call *Universal Electronics, Inc., 4555 Groves Rd., Suite 3A, Columbus OH 43232; (614)-866-4605.* Reader Service number 481.

DATALOG SOFTWARE

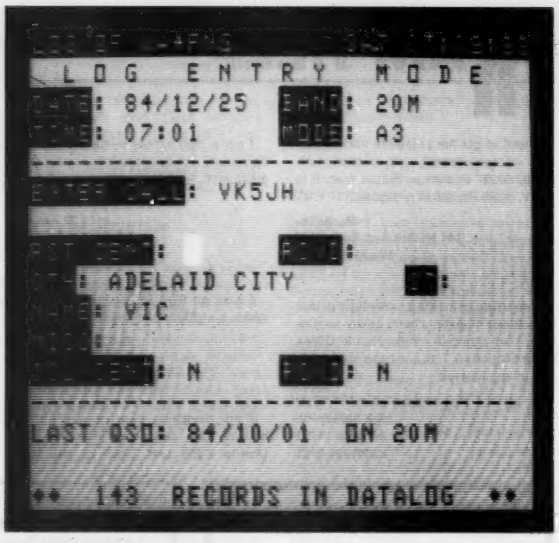
dataLOG Software announces the release of their Amateur Radio Logbook program for the TRS-80 Color Computer, the first in a series of ham-radio software to be released by dataLOG. It uses database-type record keeping to store up to 1550 QSOs in a two-drive system, or 900 in a one-drive system. It features a 24-hour software clock that automatically logs in the time when you enter a call.

The date, band, and mode of transmission can be logged in automatically or manually. After entering a call, the log is quickly scanned for any previous contacts with the station and, if any are found, the screen is updated with name, QTH, date, and band on which the last QSO was made.

The printout portion of the program allows you to search and print by date, call, prefix, or print the entire log. You may also choose alphasort and print all, stateside, or DX contacts in alphanumeric order.

An additional program, dataLOG/DXCC, is available that works in conjunction with the log program. The DXCC program produces a printout by country and prefix, listing each contact made with the country, the date and band, and the QSL status.

For additional information, please contact *dataLOG Software, PO Box 10531, Jacksonville FL 32247; (904)-398-7933.* Reader Service number 490.



dataLOG software in action.

SI-160 FREQUENCY SYNTHESIZER

The SI-160 frequency synthesizer is the latest in a series of laboratory instruments announced by Syntest Corporation. The SI-160 is an advanced 5-digit synthesizer providing ECL signals into a 50-Ohm load over the range of 20 to 160 MHz, with a resolution of 1 kHz.

Utilizing all solid-state circuitry and employing a single, phase-locked loop, this instrument provides high performance and high reliability at low cost. Temperature stability is guaranteed to ±1 ppm over the temperature range of 0–50° C.

This laboratory instrument will find applications wherever a stable, low-noise, selectable-frequency, high-reliability signal source is required. Typical applications include: plotting and alignment of active and passive filters, as a calibration standard for standard analog oscillators, a standard frequency source for AM and FM transmitters in the VHF band, and to provide a low phase-noise source for microwave oscillator stabilization.

For additional information, contact *Syntest, 40 Locke Drive, Marlboro MA 01752.* Reader Service number 483.

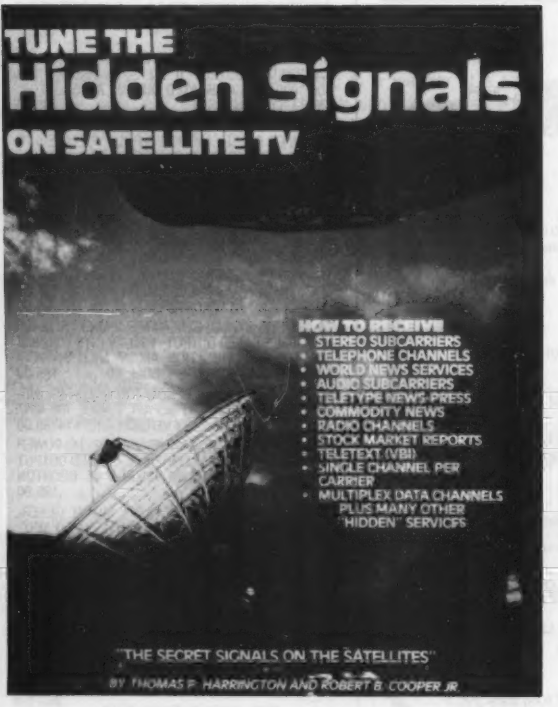
THREE FROM MIDIAN

Midian Electronics has recently introduced three new products aimed at the communications market.

The TCS-2 tunable CTCSS encoder/decoder is compatible with most commercial subaudible-tone squelch systems. It is field-tunable from 60 Hz to 250 Hz, has an adjustable audio output level, and features a wide input dynamic range.

Midian's VPU-2 tunable voice scrambler includes an anti-aliasing input filter, a six-pole tracking output filter, and is capable of simplex operation. The unit fits into most portable, mobile, and base stations, and is compatible with fixed frequency-inversion scramblers.

The TTD-4A is a subminiature DIP-switch programmable touchtone™ decoder. Features include: group and all



Satellite secrets are revealed in Universal Electronics' book.

Syntest's SI-160 frequency synthesizer.

call, 2400-Hz ring tone, horn output, latching call light, and positive or negative squelch output.

For further information about these products, write *Midian Electronics, 2302 East 22nd Street, Tucson AZ 85713.* Reader Service number 489.

TWIN OAKS CW TRAINER

Twin Oaks Associates has announced a new computerized Morse-code ear-training program which is compatible with the Apple II family of personal home computers. Features include: programmed learning with behavior modification, automated or user-selectable menus, variable speed and pitch, automatic grading of student performance, and interactive routines.

C.W. Tutorsoft teaches character, word, callsign, and QSO phrase recognition. It does this through an interrelated series of passive and active learning experiences. This program was designed and tested by experienced hams who are also mental health professionals. It applies classical learning theory and modern behavioral modification to guide students to a thorough, practical, and effective understanding of the Morse code.

C.W. Tutorsoft allows people who have no prior training in, or knowledge of, CW to train themselves; those already having some code ability, who seek greater proficiency, will also benefit from working with this new program. It's helpful in the classroom, too.

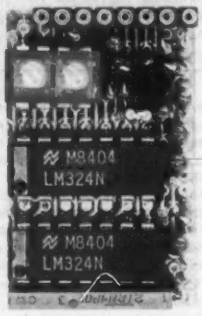
C.W. Tutorsoft is available from *Twin Oaks Associates, Route 5 Box 37, Knoxville IA 50138.* Reader Service number 486.

NEMAL CABLES

Nemal Electronics International of North Miami, Florida, has introduced a new line of direct-burial actuator cable for satellite earth station and communications applications. Each type provides the proper cabling for both motor power and sensor/control in a single polyethylene jacket suitable for direct burial.

Nemal ST-1 consists of 2 conductors of 16 gauge and 2 conductors of 22 gauge with foil shield and drain wire. Nemal ST-2 contains 2 conductors of 12 gauge and 3 conductors of 22 gauge with foil shield and drain wire. Nemal also offers a line of five types of satellite control cables which contain motor, sensor, polarotor, and coaxial signal lines.

For additional information, please contact *Nemal Electronics International, Inc., 12240 NE, 14th Avenue North, Miami FL 33161; (305)-893-3924.* Reader Service number 484.



The TCS-2 tunable CTCSS board by Midian.

MFJ-204 ANTENNA BRIDGE

The new MFJ-204 antenna bridge gives an accurate reading of your antenna's resistance (up to 500 Ohms) and covers all of the ham bands up to 30 MHz. When used to measure the resonant frequency of your antenna, you can check to see if the resonant frequency is higher or lower than desired. Then you can lengthen or shorten your antenna based on the information gathered with the MFJ-204 antenna bridge. It's easy to use: Just connect the antenna coax lead to the antenna bridge, set the frequency that you desire, and adjust the bridge for a null meter reading. Then read the antenna resistance from the dial.

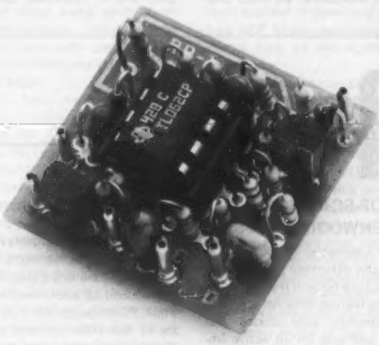
The MFJ-204 antenna bridge also has a frequency-counter jack for precise frequency measurement, and can be used as a signal generator.

The antenna bridge is enclosed in a 4" × 2" × 2" black aluminum cabinet. The MFJ-204 operates on a single 9-volt battery or 110 V ac with an MFJ-1312 adapter.

For more details, contact *MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762.* Reader Service number 485.

REVERSE-BURST ACCESSORY

Communications Specialists has introduced the RB-1 reverse-burst accessory. The RB-1 eliminates the long squelch tail heard with some reed-type and other subtone decoders. When used in conjunction with decoders that offer squelch-tail elimination, the RB-1 will delay the transmitter turn-off time and reverse the phase of the encoded tone. This immediately stops the decoder and eliminates the squelch tail.



Model RB-1 reverse-burst accessory from Communications Specialists.

For more information about the RB-1 and other tone products, contact *Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92665-4296; (800)-854-0547.* Reader Service number 487.

INTERNATIONAL RADIO CRYSTAL FILTERS

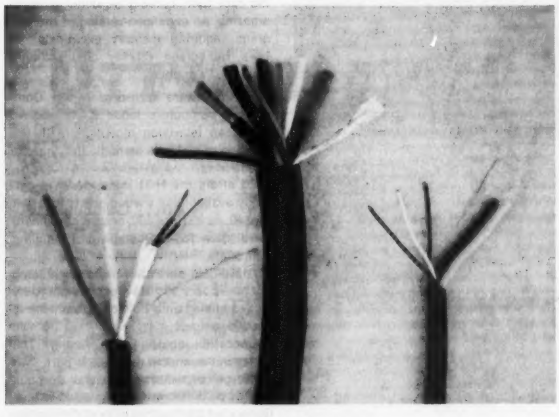
International Radio, Inc., has announced a line of eight-pole narrow filters designed to improve the selectivity of Kenwood and ICOM products.

Several kits are available, covering a wide variety of equipment and applications. Additionally, switch kits are available which allow users to switch back and forth between the rig's original filters and the new narrow filters.

For further information, contact *International Radio, Inc., 1532 SE Village Green Drive, Port St. Lucie FL 33452; (305)-335-5545.* Reader Service number 480.

COMMODORE/VIC RTTY/CW INTERFACE

This new radiocommunication package from Newsome Electronics offers Commodore/VIC owners a complete RTTY/CW



New control cables from Nemal.

The MFJ-204 antenna bridge.

system. Features include automatic speed scanning, 60-, 66-, 75-, 100-, and 132-wpm Murray, 110- and 300-baud ASCII, on-screen tuning indicators, an MSO program, 5–127-wpm CW, and crystal-controlled transmit tones.

The TU plugs into the computer's user port, and is fabricated using a solder-masked glass epoxy circuit board with plated-through holes. The only items needed for operation are two cables: audio in and audio out.

For further information, please contact *Newsome Electronics, 19675 Allen Road, Trenton MI 48183.* Reader Service number 488.

REVIEW

STOP-SCAN FOR THE KENWOOD TS-430S

I purchased a Kenwood TS-430S recently and have been extremely pleased with the operation of the rig with the exception of the scanning feature. Whether you're in program or memory scan modes, the scanner does not stop on an active frequency. In the memory scan mode, it pauses for about one second on each channel and then continues on to the next one, whether the frequency is busy or not. In the program scan mode, it scans a band of frequencies between an upper and lower limit set by the operator. In this mode, it just sweeps right past a busy frequency without any delay. Needless to say, this makes listening to a QSO in either mode very difficult because you only hear a maximum of one second or so of the transmission before it jumps on to the next channel, unless you're fast enough to hit the manual hold button.

At a local ham-swap, I saw the answer to my scanning problems. The JABCO company had a booth selling a PC board that stopped the scan whenever a signal broke the squelch, whether in program or memory scan mode, and it worked on AM, FM, CW, and SSB too!

I bought the kit version and after about 40 minutes of assembling and installing the kit, my Kenwood was scanning just like a police scanner. The kit came complete with illustrated instructions and assembly was pretty simple. There are only two ICs and a small handful of other parts that fit neatly on a 2" × 2" PC board. Adding a couple of IC sockets for the two ICs might not be a bad idea. Six wires connect the Stop-Scan to the 430S. Four of the wires plug down into the small PC sockets located on the top PC board in the Kenwood (everything is located under the top cover of the 430S). Two of the wires are soldered to the trace side of the same PC board.

This doesn't involve any more effort than it takes to add an accessory filter; the Stop-Scan instructions are quite clear on where all the interconnecting wires go and the Kenwood manual also has very clear instructions on opening the top cover and gaining access to the trace side of the PC board. On page 21 of the manual, Fig. 6-4 shows the filter disassembly detail. Once the top PC board is flipped, the Stop-Scan instructions show where to solder the two wires using a drawing of the traces showing them soldered in place.

After about 40 minutes and a cup of coffee or two, I was installing the cover back on the 430S. JABCO makes no recommendations as to mounting the Stop-Scan PC board, but since it's so small, I simply taped it up and found one of several spaces to place it. It's pretty snug inside there, but there was ample room for the Stop-Scan. Once the cover is on, the board stays right in place.

The Stop-Scan works exactly as advertised and has performed flawlessly. It is completely automatic in operation (no on/off buttons to mess with) and requires absolutely no modifications to the Kenwood. Nice for the warranty! It also is well isolated from the 430S by using rather high value resistors in series with the line coming from the Kenwood. The resume scan delay time is adjustable from about one second to about ten seconds by a small PC-mounted pot. I usually have it set at about two or three seconds. The stop action is controlled by the squelch circuit so that whenever the squelch breaks, the scan will stop. It doesn't use anything from the audio circuit so that the af gain (volume controlled) can be set anywhere with no effect on the Stop-Scan. The PC board is well made, the instructions are clear, the Stop-Scan works, and now I have a complete dream rig!

The kit sells for $18.95 but we Indiana residents have to add 5% sales tax. The kit is available through *JABCO, R1, Box 386, Alexandria, Indiana 46001.* Reader Service number 477.

Craig Graham KC9IY
Muncie IN

WELZ SP-45M SWR/POWER METER

Recently, I decided to purchase a dedicated VHF swr meter to complement my two-meter base station. I wanted to be able to accurately adjust the many commercial and home-brew antennas that I have accumulated. I headed to the local amateur-radio store and took a look at the various models available. Of primary importance were price and design. I wanted the meter to be easy to use, well designed, and portable, yet suitable for extended use in the shack. The Welz SP-45M swr and power meter, which I chose, meets these specifications and many more.

Specifications

The Welz SP-45M is designed for operation between 140 and 470 MHz at up to 100 Watts (CW). The meter has three selectable power ranges: 3, 20, and 100 Watts. It will measure forward power, reflected power, and swr between 1 and 10. The minimum power it will accept for an swr measurement is 3 Watts.

The antenna connectors are standard UHF type (SO-259). The unit weighs 0.59 kg and measures 16 cm wide by 6.5 cm high by 14.5 cm deep. The front panel is silver and the top and sides are black. Its case is metal and should stand up to even the worst treatment.

All of the controls are located on the front panel, the most prominent being the meter which is located on the left side. It has four scales: swr (1–10), power (0–100 Watts), power (0–20 Watts), and power (0–3 Watts) and is easy to read with white and red markings on a black background. All of the controls are arranged nicely and are very easy to use.

Operation

I first connected the meter between an IC-271A and a yagi. The meter fits in very nicely wih the rest of the station and is heavy enough that it is not pulled around by the coax. I proceeded to measure the swr at various frequencies and was pleased with both the performance of the antenna and the meter.

The calibration knob is sensitive enough that positioning the needle accurately is quite easy. The power measurements were accurate and the progressive scales on the meter are designed to facilitate the task of taking readings. Overall, the design and function of the meter are both excellent.

While I plan to use the meter primarily at the fixed station only, there is no reason that it could not be used while mobile or portable. After all, every last dB helps! Using the SP-45M, I adjusted the mobile whip for peak performance and am confident that the mobile station now is in top condition. The case has four pre-drilled holes on each side which could be used for mounting the unit in a car.

The wide range of VHF and UHF frequencies that the meter covers allows it to be used on the 440-MHz and 220-MHz bands in addition to 144 MHz. OSCAR operation immediately comes to mind as one of the many VHF/UHF communication methods that could be improved by properly tuned antennas. Of course, EME and DX work also apply, but care must be taken not to exceed the power ratings of the meter.

Conclusion

No matter what activities you engage in on the VHF/UHF bands, properly tuned antennas are a must, and the SP-45M swr/power meter is the right tool for the job. At the store, it stood out conspicuously among the many meters available because of its capabilities and aesthetic design. I really enjoy having a dedicated VHF/UHF swr meter and don't see how I was able to operate without one! With a price tag in the 90-dollar range, it is not exactly a minor purchase; however, I feel it was worth every cent. And that is about the best praise that anyone can give a product!

For further information, contact *Encomm, 2000 Avenue G, Suite 800, Plano TX 75074; (214)-423-0024.* Reader Service number 476.

Jonathan Mayo KR3T
Media PA

The Welz SP-45M VHF/UHF swr/power meter.

vicCOMM WIZARDRY

A wizard lives in North Carolina. Oh, he is cleverly disguised. The community thinks of him as a medical doctor, his ham friends call him AA4BB, but I know that Ed Cox is a wizard. He is ably assisted by his wife, Marty, who conjures up some pretty amazing magic of her own.

The Coxes publish *vicCOMM, The Microcomputer Journal for Commodore Computer Enthusiasts.* The first issue of *vicCOMM* appeared in January, 1983. To date, five issues have been printed. For amateurs serious about using Commodore computers, those five issues are an absolute gold mine.

Other than the "Command Post" series of articles that died with the sale of *Commander Magazine,* Ed's articles in *vicCOMM* are one of the few consistent sources for advanced applications of computers in the ham shack.

Perhaps one of his most interesting triumphs has been the creation of a slow-scan television send-and-receive program for both the VIC-20 and the C-64. A simple interface puts you on the air with SSTV.

The original version of the SSTV receive program can be loaded and operated on an unexpanded VIC! It was necessary to "compress" the picture somewhat, but the fact that it could be done at all is amazing. An expanded version of the program, requiring memory expansion, allows full-screen display of black-and-white SSTV images.

The hardware included in the Commodore computers lends itself well to slow-scan television reception. With the addition of a simple demodulator, you are in business.

Ed offers the H-31 interface. It is currently available as a wired and tested unit for $40, as a kit for $30, or as a bare board for a mere $8.00. Postage and handling runs $2.00.

I have built several of these units using the bare board and also recently got to try an assembled unit. Ed's craftsmanship is second to none.

Operation couldn't be simpler. The wired unit connects to the user port. Two RCA-type connectors stick out of the back of the board. Received audio is fed to one. Generated SSTV audio is available on the other for transmit.

The necessary software can either be typed from the listing printed in *vicCOMM* or it can be ordered on cassette tape for $5.00 or disk for $7.00. I typed the program in myself, but in retrospect, it would have been well worth the cost to get it ready to run on disk!

How well can a $50 SSTV program and interface work? If you've never seen slow scan, you are sure to be impressed almost immediately.

The only problem I found while monitoring 14.230 MHz, the SSTV calling frequency, was that there are many amateurs with newer color SSTV gear. Obviously, this program won't handle that, but believe it or not, Ed is working on that too!

With a normal SSTV signal, the picture quality using the *vicCOMM* program and H-31 interface is quite good. I've copied beautiful pictures of dogs, cats, owls, scenic views, and even a Dennis the Menace cartoon.

Certainly, the quality of the picture cannot compare with commercial units costing much more, but it is a great way to be introduced to SSTV.

The *vicCOMM* SSTV transmit program allows four messages to be stored in a VIC, or eight messages in a C-64, for transmission. The program is a little disappointing in that only small messages can be saved. Each letter is expanded to many times normal size for clarity. The full Commodore character set can be used, though, allowing for some low-resolution graphics if you are creative.

I found the transmit program adequate for simple CQ slides and such. It at least offers a way for you to participate in SSTV round tables, though you won't win any prizes for the best picture.

Over the last two years, *vicCOMM* has included a Morse send-and-receive program, a RTTY program, and numerous non-amateur programs that could have amateur-radio applications.

The next issue of *vicCOMM* promises programs for sampling, storing, and playing back voice or music. Ah yes, digital audio with a VIC-20! See what I mean? The man *is* a wizard!

A subscription to *vicCOMM* is $9.00 for six issues. Be forewarned that it is published on a somewhat erratic schedule. Even wizards have to work for a living. The wait is worth it, with each issue guaranteed to entertain and amaze you.

Both *vicCOMM* and the H-31 SSTV interface are highly recommended. Write to: *vicCOMM, Box 5491 Duke Station, Durham, North Carolina 27706.* Reader Service number 478.

Jim Grubbs K9EI
Springfield IL

SCIENCE FACT—OR FICTION?

After you have read *Solution's to Tesla's Secrets and the Soviet Tesla Weapons*, you may have the same feelings I did: amazement, awe, admiration, and great interest—mixed with a leavening amount of skepticism.

Certainly, there is no question that Nikola Tesla was one of the great geniuses of the twentieth century; some say of *any* century since the Renaissance. He was the "father" of alternating current who invented the ac generator, and with financial backing from George Westinghouse, succeeded in harnessing Niagara Falls for the production of electricity.

He succeeded in producing electrical and sound oscillations having frequencies beyond anything imagined at the time—prior to 1900! He actually produced millimeter waves and envisioned radar, sonar, remote control, missile guidance systems, and dozens of other "modern" inventions. He produced X rays by a new technique, and "cold light" whereby gas-filled tubes were lit in his laboratory without visible connection to a power source. Beyond that, he had ideas (demonstrated in small scale before dozens of witnesses) for transmitting power through the earth—wirelessly—to any point on Earth. His achievements won him the 1915 Nobel Prize.

Tesla began his life in a small town in what is now Yugoslavia. He came to the United States in his early 20s with just a few cents in his pocket. Although he spoke no English, he found apprenticeship at a small electric motor repair shop in New York City.

From there he began his lifetime of experimenting and studying which led him to the virtual control of nature... and to a sad, bitter, and lonely end in 1943. Tesla was, indeed, a *Prodigal Genius* as he was called by John J. O'Neill, one of his biographers, in the book of the same name.

The book reviewed here is in two parts: *Solutions to Tesla's Secrets and the Soviet Tesla Weapons*, by Bearden, and *Reference Articles for Solutions to Tesla's Secrets*, compiled by John T. Ratzlaff.

Author Bearden's credentials are impressive: he is a nuclear engineer, a war games analyst and military tactician, a retired officer with over 26 years experience in air defense systems, tactics and operations, technical intelligence, anti-radiation missile countermeasures, nuclear weapons deployment, computerized war games, and military systems requirements.

He is currently (1981) with the Alabama division of a large aerospace company where he is involved in determining the future requirements for laser weapons.

All of these lend credibility to the things that he writes about which seem so incredible on the surface...things that he tells us about Tesla and—perhaps more importantly—the recent work done by the Soviets. Let's begin.

Before 1900, Tesla had succeeded in producing and demonstrating the effects of what have since become known as Tesla waves. He repeatedly stated that they were non-Hertzian in nature—being scalar longitudinal waves rather than transverse vector waves.

Among uses for his waves planned by Tesla was the production of "free" energy for the use of anyone, anywhere on earth. All that would have been needed was a Tesla generator to transmit the energy and a suitable "antenna" at each receiving site. Bearden says that this knowledge was suppressed and Tesla was deliberately isolated because of the economic implications of such a device and the threat that it would pose to the established power structure.

According to Bearden, orthodox electromagnetic theory has a basic flaw involving definition of electrostatic potential, and it is this flaw which has prevented scientists and technicians from recognizing and utilizing the Tesla discoveries. The author states that our ordinary three-dimensional electromagnetic theory is merely a special and limited case of four-dimensional scalar electrostatic potential theory, which involves time as the extra dimension. The explanation, with examples, is given in great detail by Bearden, although I had trouble trying to understand exactly what was being said.

The essence is that a Tesla wave is a massless wave which does not obey the laws of physics as known today, and that electromagnetic effects such as radio waves, light waves, and the like are pair-coupled Tesla waves—all of which leads to a new concept of super-relativity which goes beyond the Einsteinian concept.

Naturally, this is all pretty hard to swallow, and the implications may be even more difficult to get down without considerable chewing.

Examples of Tesla waves in action can be seen in the so-called "spooklights" which appear over the mountains at night, especially in areas of tectonic fault zones where highly-stressed quartz-bearing rocks produce piezo electricity and, as a side effect, Tesla waves. Tesla waves can combine with each other to produce what Bearden calls a scalar interferometer, augmenting and diminishing in patterns that follow a Fourier series expansion.

It is also suggested that thunderclouds and severe electrical discharges from cloud to cloud or cloud to ground can produce SEP (scalar electrostatic potential) effects such as ball lightning, plasma, and the like.

Impossible as it may seem, Tesla waves could possibly affect both space and time (individually and separately, or together in various combinations) and therefore affect such "constants" as gravity, mass, inertia, and even human thought!

Other workers in this esoteric field in the early 1900s included James Harris Rogers, who patented an underground and undersea antenna sytem that was used during World War I to communicate with submerged submarines and to communicate with American Expeditionary Forces in Europe *through the earth!*

T. Henry Morey of Salt Lake City succeeded in tapping the limitless "zero-point energy" of space-time itself through his invention and development of special amplifiers. By 1939 he had produced a 29-stage amplifier that produced 50 kilowatts of electricity from a vacuum! The tubes (which had taken Morey years to perfect) were destroyed by a Russian agent after the Russians had obtained the drawings for themselves, and the device! Today, the Morey amplifier is a standard component of many of the Soviet secret weapons and Tesla superweapons, according to Mr. Bearden.

Examples of other available Tesla literature are: *Bedini's Free Energy Generator, Star Wars Now* (including a description of the basic mechanism by which Soviet control of North American weather is possible—and evidence of its extensive testing), *The Bridge to Infinity* (a book about the secrets of gravitation, space-time travel, the world's electromagnetic grid system, and much more), and a 600-copy limited edition of the *Tesla Patent Wrappers*.

This material is described in a publications list available from the Tesla Book Company. The titles are reasonable in price—some are surprisingly low, in fact. The book reviewed here, an 8½" × 11" spiral-bound softcover, retails for $14.00. Please add $1.50 for shipping and handling.

For those of you who may be interested in reading all of the available Tesla literature, plus much more by various authors about similar subject material, write to the *Tesla Book Company, 1580 Magnolia Avenue, Millbrae, California 94030, or call (415)-697-4903.* Reader Service number 479.

Jim Gray W1XU
73 Staff

RTTY LOOP

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My neighbor just stopped over after spending some time up in Punxsutawney. For those of you who remain uninformed, that Pennsylvania town is the home of Punxsutawney Phil, the official Groundhog Day mascot, by whose vision the severity of the remainder of winter is determined each February 2nd. I even used to get a brochure every few years from the amateur-radio group up there which watched out for Phil. Good luck this year!

Well, somehow I guess I should get from that topic to the lead item in this month's column. Unfortunately, I can't think of a smooth way, so let's just plunge in. I have received in the mail the two newest publications from Joerg Klingenfuss Publications, the third edition of his *Guide To Utility Stations* and the seventh edition of the *Radioteletype Code Manual*. These are monumental works, at least one of which should be a part of any RTTYer's library.

The smaller of the two works, the *Radioteletype Code Manual*, is a seventy-one-page booklet that covers the non-ASCII radioteletype codes along with several variations on the Morse code. For those of you who have been looking for the information, here is a detailed description of the CCIR-467-3 specifications that define amateur-service AMTOR along with other ARQ and SITOR standards. Some of the nonstandard RTTY codes covered include those used to send Arabic, Cyrillic, and Hebrew. Of the three, Hebrew is only briefly explained with a code chart, an omission I hope will be corrected in future editions. Somewhat more information is given about Cyrillic, and extensive coverage is given to Arabic, with a long list of words printed on a conventional teleprinter with their Arabic translation. For example, BMYCUB = America and YBRCT = radio. Beyond the conventional five-level code, the book also deals with the third-shift codes, so called because they represent a third character set (other than letters or figures) which is used in the Amharic, Cyrillic, Greek, Korean, Thai, and Japanese radioteleprinter systems.

If that is not enough, some of the more exotic versions of Morse code are covered as well. Alphabets are shown for sending Arabic, Cyrillic, Greek, Hebrew, and Japanese with a code key. There are also entire sections on terminology, how ARQ systems work, and an introduction to simple cryptology. Let me tell you, these are some meaty seventy-one pages!

If these are meaty, try amd imagine the 427-page *Guide To Utility Stations*. Almost an inch thick, this tome of a work covers over 14,000 individual frequencies between 1.6 MHz and 30 MHz, using modes of transmission including CW, fax, SSB, and RTTY in its various permutations. Seventy-eight RTTY press services are listed on almost five hundred frequencies in the master list, as well as in a chronological list by time of day of transmission and alphabetically in country order. Alphabetical indices are also provided for a slew of meteorological RTTY stations,

mnemonic abbreviations, service codes, Q signals, Z codes, utility stations, signal reporting codes . . . well, you get the idea.

As an extra added attraction, three maps are provided, each one 8.85 by 18 inches in size, which show air routes and VOLMET Allotment and Reception areas. Quite a package in one handy book!

These publications, along with several others, are available from Joerg Klingenfuss Publications, Panoramastrasse 81, DF-7400 Tuebingen, Federal Republic of Germany. The prices for the *Radioteletype Code Manual* and *Guide To Utility Stations* are DM25 and DM60, respectively. I presume that the dollar amounts would vary with the current exchange rate. Be sure to let Joerg know you read about it here, OK?

Is anybody out there interested in packet radio? I have received a few inquiries on the subject; one is sitting here from Gail F. Moulton, Jr. WA6KJD of Trona CA. I have asked around to some of the mavens in this area, but it looks like whatever interest existed a few years back has dried up. Drop me a line with whatever you think on the subject.

Another problem area is parts for older RTTY machines. Again, years ago there were many parts houses which stocked platens, print boxes, and gears for various Teletype Corporation machines. Now, with the electronic clean sweep, these sources are few and far between. Specifically, I have a note from Bob Klein K9RTB of Beaver Dam, Wisconsin, who has been looking in vain for a model 28 print box. Can anyone help him out? Send me your name and I will forward it to him. We'll see what we come up with, Bob.

I have been toying with various schemes to put the computer back on the air. One of the things we need to do is look at what each of you who are using a computer on RTTY is using for hardware and software. So, this month, I would ask each and every Apple (I, II, II+, IIe, IIc) or Apple-clone user to drop me a note and tell me what kind of software you are using on RTTY. Now, before I get flogged, *not* McIntosh, Lisa, or the like, *please*. I am trying to compile some sort of order out of all this and hope to do this over the next few months, with the results to follow when all is in.

Meanwhile, the TRS-80C Color Computer® continues to rack up the brownie points here. After examining a versatile expansion bus and 80-column terminal card for the CoCo—more on those later—I am convinced that this is the way to go for the serious user. Total cost of a full RTTY system should be nominal, and it is buildable in stages ranging from a tape-based TV display to a full-disk-access, multi-user, 80 × 24 terminal—and all based on the same computer. There *will* be more on this one later!

I appreciated a comment received from Fred F. Kloman of Laguna Niguel CA. Fred notes the explanations of the various "bit formats" in the September column and indicates the need for a standard. Only one item of confusion in the letter, Fred. You write about the "RS-232 bit format" in terms that suggest you are confusing RS-232, which is the medium, with ASCII, which is the message. One of the points I tried to make in September—I hope I said it clearly enough—is that the American Standard Code for Information Interchange, ASCII, determines the bit format for transmission. Seven bits, eight bits, even six bits for uppercase only have been used, with one, two, or some fraction in between as a stop bit. The point is that all this defines is the format of bits, not the voltage levels on the line. After all, ASCII being transmitted over a radio signal is still ASCII, but it is hardly RS-232. The RS-232 (-C or whatever) standard addresses the voltage levels needed to signal the desired bits over the circuit, without regard for what the particular format in use is—ASCII, Murray, or even Morse! Yes, the two can be related, but no, they are not the same any more than voltage and current are. And that's the message I was trying to get across. Thanks, Fred, for the excellent question.

Fred also asked for, and received, the latest list of reprints of old "RTTY Loop" columns. This column is written too far ahead of reality for me to tell you how many or on what subjects reprints are available, but I have been trying to put together some of the more popular subjects into readable form. An up-to-date list is available by sending a self-addressed, stamped enveloped to me at the above address (request the reprint list). If you want to, add a question, point, or some information for the rest of the readership along with the request—wonderful! Who knows, you may end up like Fred, reading your name in "RTTY Loop."

DX

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DXING IN CONTESTS

Radio propagation has not been kind to DXers in the last year. And there seems to be little reason for hope that the situation will improve. Ten meters provides only occasional flashes of activity, and even 15 meters supports good DXing only during daylight hours. As 20 meters washes out late at night, more DXers are crowding into the lower bands, or (God forbid!) giving up the frustrating practice of DXing at the sunspot minimum.

What can the die-hard DXer do to maintain interest and enthusiasm for the sport? We'll look at a variety of ways in coming months, starting with DXing during contests.

Many DXers hate contesters and contesting, claiming that these weekend fanatics overcrowd the bands and destroy any chance for serious DXing. However, in all but a couple of contests, the other mode is seldom affected by the contest. For example, even if the *CQ* Worldwide DX Contest fills the phone bands, there is always CW. And seldom do contesters completely fill a band; the upper end is usually free of the contest frenzy.

DX contests offer the DXer some unique opportunities to expand his DX horizons, and also to add a few more new ones to that DXCC total. Since the spring contest season is about to begin, let's see how you can work several new countries, practically painlessly, during a DX contest.

What advantages do contests offer the DXer? First, contests create a lot of activity on the bands. Stations which seldom operate often gear up specifically for a major contest, providing more DX opportunities. Also, these stations are trying to make as many contacts as they can, since that is, after all, the point of the contest. These DX stations are actually eager to work you.

So you have a lot more stations on the air, all more than willing to listen for your call. DX contests also bring out many DXpeditions to rare and not-so-rare places. While no major DXpedition to a "most wanted" spot will pick a contest weekend to operate, many "suitcase DXpeditioners" head to the Caribbean, the Pacific, Africa, and South America to operate during the contest.

Unlike resident DX hams, these contest DXpeditioners have not yet tired of working hundreds of stateside hams, so your chances of a successful contact improve. Typically, these contest trips feature a stateside QSL manager, which simplifies the confirmation process (more on this below).

Finally, contests provide many DX opportunities on the marginal bands. Even if 10 meters is closed there will be a few hard-core contesters on the band keeping it warm. Under identical conditions without the contest, the band would be completely dead, but during the contest, there will always be a few stations on the air. Since these stations are calling CQ into a dead band, if you can hear them, you can probably work them with little competition.

You don't have to enter the contest to participate. In fact, only a small fraction of the hams who make contacts during the contest ever submit logs to the contest organizer, which is the usual means of entering the contest. Most hams simply include their contest contacts in with their other QSOs in their logs. No need for any special forms, log sheets, or other paperwork.

However, you *should* have a copy of the rules of the contest at hand. Before the contest, read through the rules until you are thoroughly familiar with the descriptions of permissible contacts and the complete contest exchange. You can find the rules in an issue of the magazine of the sponsoring organization, or by writing to the sponsor and asking for a copy of the rules. Always include a large self-addressed, stamped envelope with your request.

You must be familiar with the rules so that you can make contacts in the contest as rapidly as the more active participants, to keep the DX station happy. Also, you want to ensure that your contact with the DX station complies with the rules of the contest, so that your log entry isn't deleted after the contest is over.

Fortunately, the rules for most major DX contests are very similar. You may work stations outside your own country (and some within your country) once on each band. DX contesters take a very dim view of duplicate contacts on the same band ("dupes" in contesting lingo), so try to make your contact count the first time. If you cannot sleep without an "insurance" contact, make it on another band.

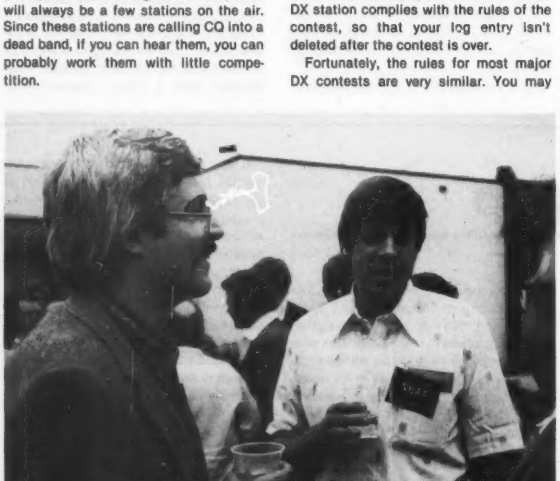
I've had stations work me a half dozen times on each band, and QSL every contact. This means I have to carefully remove each duplicate contact from my contest log before I send it in, because there are severe penalties for failing to remove the dupes. Obviously, I am not going to look with favor upon the DXer who works me several times on each band.

The other reason to check the rules is to learn the proper exchange for the contest. By reading the rules about the contest exchange, the DXer can call the DX station, provide exactly the right information for a complete contest contact, and leave the DX station to his point-gathering. If the DX station has to ask a series of questions to get the information he needs, he might simply forget about your contact, and work someone else.

For most DX contests, the exchange is very simple: the DX station's callsign, signal report, and one additional piece of information. The latter might be a geographic designator, such as *CQ* or IARU zones or the states. In some cases the additional piece of information exchanged is a consecutive serial number. Before the contest begins, prepare the information you should send to the DX station.

About signal reports: Contesting signal reports are *always* 59 or 5NN. Nobody pays any attention to these figures, and sending other than a 59 or 5NN simply confuses the DX station. In fact, many contesters duplicate their logs with the "59" already in place.

Yes, it certainly seems silly to slave to pull some contact out of the mud, and then turn around and give a 59 report to a station whose callsign you could barely copy, but giving accurate signal reports in a contest wins no friends!



Dick Norton N6AA (right) discusses contest strategy with Rick Niswander K7GM. Dick has made many thousands of contest QSOs from 9Y4VT in the CQ WW Contests.

Making the Contest QSO

Okay, now you're all set for the start of the contest. Your log is ready, you know the rules, and you have the contest exchange you will send all prepared. So how do you work new DX countries in the me-

lee? Since you are not seriously entering the contest, your strategy will be different from that of the regular contest entrant. Presumably you have little interest in working strings of Japanese or German stations (if you do, why not enter the contest more seriously?), so you can ignore most of what you hear.

A good way to separate the DX you want from the rest of the contesters is to keep a "band plan." As you tune across the band listening to the pileups, you can identify the calls of the DX stations (or stateside stations calling "CQ TEST"). One or more of the pileups might contain a station you need, but the rest you can quickly tune by. By logging the frequencies of the stations you need, you can quickly tune back and forth, while skipping all the other contesters.

Pileup busting works the same way in contests as in DX, and many of the same techniques work. Avoid giving only part of your callsign, however, and never repeat your call in a contest pileup. The DX station might well get your entire call on the first try. Also, if one call didn't work, wait until the next QSO and try again.

If you find your peanut whistle isn't cracking the big pileups, don't despair. Try a different band, where the competition isn't as fierce. Or try at a different time of day, or later in the weekend. By Sunday afternoon, many of the major DX contesters have worked all the Big Guns in the contest and are now copying much weaker signals. Give it another try!

A good sign that you're *not* getting through is when the DX station continues to call CQ after your call. If he can hear anything at all, he'll probably try to make the contact rather than continue to call CQ.

Unfortunately, not all the good DX on the air during the contest consists of large, well-equipped stations on every band calling CQ. Some will be distinctly weaker, on for a shorter period of time, and generally more difficult to work. While not "sure things" like the big contest DXpeditions, these DX stations are usually workable by average stations. The trick is to keep tuning around the bands which are open, listening for these signals. Your band plan can help you skip over many of the pileups, so you can scan several bands in a short period of time.

Look for the DX stations near the fringes of the contest QRM. The really Big Guns slug it out down in the lower reaches of the band; higher up the weaker stations gather. So tune up to where the contesters begin to thin out. You'll often find some good DX up there, hiding from the hordes.

Working the "Hunt and Peck" Station

Perhaps the most frustrating aspect of contesting with other than a winning station is to listen to the great DX which is calling one of these superstations. The Big Guns call CQ continuously, and their strong signals attract a lot of choice DX.

Obviously, you can't hope to compete with some of these guys. The DX is not going to flock to your door in the same manner. But just because you don't own a Big Gun station doesn't mean you can't work much of this choice DX.

These "hunt and peck" stations tune across the band, answering CQs. They usually move in one direction along the band, jumping into every pileup. If you can tell which direction this DX station is tuning, you have good chance of working him, even with a peanut whistle.

After you have worked the few DX stations which are calling CQ themselves, you might start listening to a strong stateside station near the bottom edge of the band. When you hear one of the rarer DX stations calling the stateside contest CQer, tune up the band and see if you can follow that rare station. Perhaps you will hear it again a few kilohertz higher in the band, calling another CQer.

Once you have established a pattern for the DX station, try to get a few kilohertz ahead of him. Tune up a little higher in the band than his last contact, and, wedging between the other stations, call a CQ, a directional CQ, or even call the station directly.

Since the DX station is tuning for CQs, and your CQ is just higher in frequency than his last contact, the odds are that he might just hear your CQ and call you. Even if the frequency you choose is very crowded, you might be able to make that single contact.

A directional CQ might improve your chances. If the station you want is from Africa, try calling "CQ Africa" when you get a few kilohertz ahead of him.

If the station you want doesn't answer your CQ, check the next higher pileup to see if he skipped over your weaker signal. If so, get ahead and try it again. If there is as much as a moment's pause between the Big Gun contesters, you have good chance of making the contact.

Another way of snagging those rarer stations working the Big Gun DXers is to try to call the DX station on the Big Gun's frequency. This technique takes very careful timing and a reasonably understanding Big Gun. Typically, you call, "T32AW, up five!" when the Big Gun is not transmitting. Of course, the DX station cannot be transmitting, either, which makes the timing so important. In a hectic contest, there aren't many gaps between transmissions.

If your timing was good and the Big Gun didn't jump all over your signal as soon as you started to transmit, the rare DX station might well listen for your call for a few seconds five kilohertz higher. That frequency doesn't have to be clear, as you will only need it for a moment.

By the way, unless you have a very good signal, don't try to work the DX station on the same frequency as the Big Gun. Said Big Gun will most likely start calling CQ right over your peanut whistle.

Confirming the Contest QSO

The contest is over, the bands have returned to normal, and your log contains a half dozen new countries. Now we come to the tough part: getting the QSL.

If you look for differences between a DXer and a contester, about the most glaring is QSLing. To the DXer, those QSL cards are the reason for the entire exercise. On the other hand, QSLs are just a pain to the contester. After every major contest, the active contester is swamped by QSL requests.

To some contesters, QSLs simply aren't worth the trouble and expense. QSL requests are simply filed in the Circular File. I know one contester who even throws away SASEs. The only thing in which he is interested is the occasional dollar bill. So your QSL return rate for contest contacts will be even lower than normal.

There are a few things you can do to improve your contest QSL return rate, however. First, get the proper QSL address for the contact. Don't ask the poor DX station in the middle of a contest for his QSL information. Either he will give that information on a regular basis, on the hour, for example, or you can find the QSL route via your club newsletter, DX bulletin, or other source.

Note that many club stations have special QSL routes for contests. 4U1ITU in Geneva might have different QSL managers for each contest, depending on the guest operator for the contest.

Pay particular attention to the contest DXpeditions. It is seldom useful to send a contest DXpedition QSL card via the bureau. The card will never get to the country before the DXpeditioners have departed, and there is often no way to forward these contest cards. There are literally thousands of QSLs gathering mold on Montserrat, all bureau cards for DXpedition contacts, with no forwarding addresses. Or, take my recent trip to T32AW. There is *no* regular mail service to Christmas Island. No ham on Christmas has ever received a QSL card via the bureau. So find out what the correct, stateside QSL route should be and use it. I find the W6GO/K6HHD QSL Manager List (PO Box 700, Rio Linda, CA 95673) quite accurate and useful.

Another trick to improve you chances of confirming a contest QSO is to indicate on your QSL card that this was a contest contact. Many active DX stations keep their contest logs separate from their main log. If you simply indicate the date, without mentioning the contest, the DX station might notice no QSOs in his regular log for that date and fail to answer.

Accurate timekeeping is vital for contest QSLing. A contester might make 6-7 contacts a minute and fill a contest log page in less than 10 minutes. If your clock is off by 5-10 minutes, the DX station might have to search through dozens or hundreds of contacts for your call. Or he might get tired of this and return or discard your card. So check your station clock against WWV before the contest begins.

And be careful about band changes. It is very easy in a contest to change bands and forget to record this information in your log. If you send out the card based on incorrect log data, the DX station might find he wasn't even on the band you claimed. On those rarer contacts, double-check the band right after the contact, or better still, make out the QSL card right on the spot.

One final tip for better contest QSLing: In contests with a consecutive serial number, give the *DX station's* serial number on your card, not your own. In the CQ WPX Contest, for example, write "UR # 1056" on the card. Assuming you logged the correct number, your QSO will be very easy to find, even if you got the time and band wrong.

DXing during contests is not easy, but it can be very rewarding. And who knows, you might even discover you *like* the frantic pace and excitement of the radio contest. Even if not, you can catch a few new ones and work on your band country totals over the weekend. See you in the pileups!

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of February are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
1233	1	1600	138	45	118	33	97	12
1235	2	1500	123	39	107	25	88	4
1237	3	1500	121	33	106	19		
1238	4	0200					274	0
1239	4	1400	110	25	97	11		
1240	5	0200					268	3
1241	5	1300	100	17	89	3		
1242	6	0100					262	13
1243	6	1300	99	11				
1244	7	0000			272	1	255	23
1245	7	1200	91	3				
1248	8	2300	272	0	260	13	240	34
1250	9	2200	266	8	253	23	228	43
1252	10	2200	260	10	247	24	219	44
1254	11	2100	253	20	237	34	203	50
1256	12	2000	245	30	226	43	182	54
1258	13	2000	238	31	217	43	173	50
1260	14	1900	226	40	201	49	153	49
1262	15	1800	212	47	181	52	136	44
1264	16	1800	202	46	172	48	132	38
1266	17	1700	183	50	153	47	120	31
1268	18	1600	163	50	136	42	109	23
1270	19	1600	156	45	133	36	108	17
1272	20	1500	140	41	120	29	99	9
1274	21	1400	125	35	109	22	91	0
1276	22	1300	114	28	100	13		
1277	23	0100					270	0
1278	23	1300	112	22	99	8		
1279	24	0000					264	9
1280	24	1200	103	14	91	0		
1282	25	1100	94	5				
1283	25	2300			269	0	251	21
1284	26	1100	93	0				
1285	26	2200			262	9	243	31
1287	27	2200	268	0	257	11	235	32
1288	28	2100	262	7	249	21	224	41

BE MY GUEST

Guest Editorial by Bill Pasternak WA6ITF

THE DARK SIDE

I hadn't really planned on being in the Big Apple that weekend, not with the Democratic Convention followed by the Summer Olympic Games and then the Republican conclave. As a broadcaster, it was for me a rather busy summer, and if I was going to be anywhere other than Los Angeles that weekend, I expected it might have been Dallas. As the draw of the cards would have it, the TV station that I work for elected not to send a crew to the Republican conclave, so I had no excuse not to attend my brother-in-law's wedding out on Long Island.

Travel arrangements were hastily made. My wife had departed earlier in the week, and as the sun broke over the Verdugo Hills, the American Airlines DC-9 Super 80 Jetliner I was on broke free of the tarmac at Hollywood-Burbank Airport and roared skyward. As we made our climbing turn to the northeast, the sunshine broke through the cabin windows and I beheld the City of Angels far below. Soon we were at 39,000 feet and cruising at better than 600 mph toward Chicago. For the next 3½ hours I slept. In fact, it was the main gear touching down at O'Hare Airport in Chicago that brought me back to my senses. "What a delightful ride," I thought to myself, "the start of a perfect, though hurried, weekend." Ten minutes later I was eating lunch at one of O'Hare's many food stands with my friend Joe Schroeder W9JUV, and a hour later I was airborne again on a Boeing 727 headed toward New York City and La Guardia Airport.

One of the nice things about arriving in New York via La Guardia is that you can play "flying traffic reporter" as the aircraft descends toward the runway. From either side of the aircraft you get a spectacular view of the New York City highway system, and it can help you to plan your driving strategy, especially during rush hour. That is, if you know which highway is which. Having been brought up in the city, and having learned to fly light aircraft there, the landscape was quite familiar. Soon I had picked up the rental car, had the mag-mount on the roof, the IC-2AT plugged into the cigarette lighter, and was headed west on the Grand Central Parkway. A quick interchange to the southbound Brooklyn-Queens Expressway and I was on the last leg of my trip.

A few of my friends knew that I would be arriving, so we had scheduled a repeater to meet on to chat. Alas, that one was down, but New York City is overflowing with machines, and a bit of searching brought me to the Metroplex system. Soon I was in QSO with a number of old acquaintances, and in short order my friends located me on the Metroplex box. That repeater, being the meeting place for just about every ham in the New York/New Jersey area, is always very busy, so my friends and I QSYed to a quieter system that one of them suggested. We talked until I "destinated," after which the HT was put away in deference to family obligations. After almost a week of playing bachelor, it was nice to see Sharon again.

It was the next morning that the unfortunate incident occurred. My wife and her folks had left early to take care of some last-minute preparations, and I was to meet them out on Long Island a few hours later. With nothing much to do, I decided to drive over to my old neighborhood to take a look around. Just for nostalgia's sake. Even though this was my fourth trip to New York this year, in the past all had been for business and had left no time to look and see how time had treated the place where I had grown up.

With the 2-meter radio still set to the repeater used the night before, I began my drive down Avenue K. My first stop would be on East 18 Street to say hello to Max Levy, the father of my longtime friend Larry Levy WA2INM. Larry's mom and dad had always been my second family, and whenever time permitted I would visit them if I was in town. Carol had passed on a few years ago, but Max was still living in that same beautiful house that gave birth to many 6-meter DX records of the late 1950s and early 1960s, when Larry and I would spend hours tinkering, building and improving his station. The Telrex beam was gone, but the memories of those days were still very much alive.

I was near Nostrand Avenue and in QSO with a couple of amiable chaps when an acquaintance of many years broke in to say hello. Since he lived in my old neighborhood, I suggested that we have a late breakfast together. As he attempted to reply, his transmission was jammed. I attributed this to the same type of mentality that appears to abound on 2-meter repeaters in the Los Angeles area, and asked that he repeat his answer. Again he was jammed, but this time with a new twist. Instead of an unmodulated carrier, as had been the case a moment earlier, this time the jamming station announced quite clearly that he was jamming the station I was in QSO with *because my acquaintance was not welcome on the machine!* I was so dumbfounded by this that I instinctively reached for my pack with the tape recorder in it, and almost ran the car onto the sidewalk in the process. "The nerve of this *!!?*! Who in the !@*! does he think he is? A repeater god?" I thought to myself. Another unidentified station who was also being partially jammed by this self-annointed repeater cop helped to clear the air a bit by saying that it was the practice of that particular machine to censor anyone they didn't want on. I'm still not exactly sure as to what he did say, since his partner in grime was busy keying down, thinking he was jamming out the station I was attempting to QSO. Since it soon became obvious that the censorship was selectively aimed at the other station in the QSO, I knew that he could hear me and suggested that we go to simplex, since I was sure that we were in range to make direct contact. Bidding a not-so-fond farewell to the channel cops, we QSYed to .52 where we were not again interrupted.

I made a quick stop to see Max, and then drove over to have breakfast with my ham buddy. I didn't bother to ask him why he had been treated so discourteously on that particular repeater, nor did he bother to offer this information. Frankly, I felt that part of it was between him and the rest of the system, and not my concern. Or was it?

After we bid each other farewell, I drove up and down several blocks of my old neighborhood, passing the houses where I grew up, the public school I attended and the like, but my mind was not on the scenery. Rather, I could not put that incident out of my mind. The disgusting lack of courtesy displayed by that channel cop and his supporters was something I could not stomach. In my mind, what had transpired an hour earlier was the epitome of wanton, vicious, and *intentional* malicious interference. The words of FCC Private Radio Bureau Chief Robert Foosaner kept going through my mind. "...there are always reasons for jamming, but we (the FCC) don't care what your reasons are. If you do it, we will catch you and we will take away your license..." To me, channel cops, especially the self-annointed variety, exist at the same level as those who perpetrate acts of malicious interference so as to gain attention. In this case, the two were one and the same. Had it not been a Saturday, I probably would have found the nearest pay telephone and called Carol Fox Foelak of the FCC's Compliance Division to give her a first-hand "ear-witness" account of this incident. The channel cop should thank the Lord that it was a weekend, and that Washington was locked up tight. I did have Johnny Johnston's home number in my little blue book, but decided that doing the "big number" on the channel cop wasn't worth disrupting Johnny's weekend. Still, I was burning mad, and I guess that I still am, for several reasons.

First, and most importantly, whatever it was that was so disliked by the users of this repeater about the station I was QSOing was no justification for violating the law. Yet this self-styled channel policeman not only had the gall to violate Part 97, but the pride to *announce that he was doing it!* To this writer, that is malicious interference of the worst kind, ranking with the utterance of obscene language for the sake of doing so. Both are wrong. Both are violations of the law. Both deserve punishment.

Just as upsetting was the overall rudeness of the channel cop and his obvious supporters toward a visitor. If this had been a private repeater with a selective usership, then I might have been able to accept the fact that visitors were unwelcome, had that been explained. Being a user on two such systems in Los Angeles, I can understand that type of thinking. But this was an open system, and a fairly popular one at that. The unwritten rule pertaining to open systems is that *all* comers are welcome. At least that's the way it is elsewhere in the United States. Had one of the control stations come onto the channel and asked that we QSY, I would have been happy to oblige. I'm not one to go where I am not welcome. But that didn't happen. Instead, the users took it upon themselves to censor a station I wanted to converse with, and in doing so, took the law into their own hands, vigilante style. This is something I cannot ever accept.

I hasten to add that this problem appears to be isolated to one particular NYC system at the moment, and I have written to the system's licensee, apprising him of the matter. Maybe he can find a way to gain control over his usership and explain that their activities are placing *his* license in jeopardy, as he is held legally responsible for the manner in which the system is operated. Who knows, maybe they will even listen to him. Probably not, if I know New Yorkers. It was that type of attitude that was in part responsible for my moving away.

Either way, I think it is important to point out that hate only breeds more hate, and on a repeater this can only lead to chaos and anarchy. I bear witness to this, and I can only hope that the channel-cop cancer does not spread. It was the channel cops who were responsible for most of the chaos during the STS-9 "Ham in Space" operation last year, and we don't need a nationwide repeater network filled with them.

Bill Pasternak WA6ITF is the Network Director for Westlink. *A broadcast engineer by trade, Bill has been a contributor to 73 for many years.*

CORRECTIONS

Two corrections to "Nitty Grtty RTTY" in the September, 1984, issue have come to our attention. First, in Fig. 1 on page 39, the lower-left op-amp section should have a 0.1-uF capacitor connected between the wiper of the 100k pot and the 33k input resistor. Second, in Fig. 2 on the same page, pin 4 of IC4 should be brought to ground.

Peter Putman KT2B advises us that in his January, 1985, article, "That Glorious Gonset," the diodes specified for the new power supply (D1–D4) may not have a sufficient reverse-voltage specification. Peter suggests using instead the circuit shown in Fig. 1.

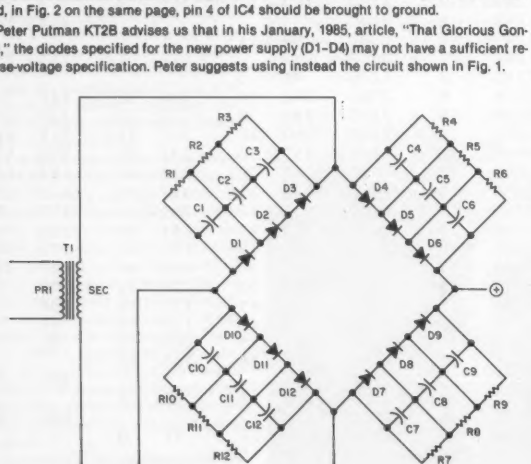


Fig. 1. New high-voltage supply for "That Glorious Gonset."

TUBES

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2K28	200.00	4624	310.00	7854	130.00
3-500Z	102.00	4657	84.00	ML7855KAL	125.00
3-1000Z/8164	400.00	4662	100.00	7984	14.95
3B28/866A	9.50	4665	500.00	8072	84.00
3CX400U7/8961	255.00	4687	P.O.R.	8106	5.00
3CX1000A7/8283	526.00	5675	42.00	8117A	225.00
3CX3000F1/8239	567.00	5721	250.00	8121	110.00
3CW30000H7	1700.00	5768	125.00	8122	110.00
3X2500A3	473.00	5819	119.00	8134	470.00
3X3000F1	567.00	5836	232.50	8156	12.00
4-65A/8165	69.00	5837	232.50	8233	60.00
4-125A/4D21	79.00	5861	140.00	8236	35.00
4-250A/5D22	98.00	5867A	185.00	8295/PL172	500.00
4-400A/8438	98.00	5868/AX9902	270.00	8458	35.00
4-400B/7527	110.00	5876/A	42.00	8462	130.00
4-400C/6775	110.00	5881/6L6	8.00	8505A	95.00
4-1000A/8166	444.00	5893	60.00	8533W	136.00
4CX250B/7203	54.00	5894/A	54.00	8560/A	75.00
4CX250FG/8621	75.00	5894B/8737	54.00	8560AS	100.00
4CX250K/8245	125.00	5946	395.00	8608	38.00
4CX250R/7580W	90.00	6083/AZ9909	95.00	8624	100.00
4CX300A/8167	170.00	6146/6146A	8.50	8637	70.00
4CX350A/8321	110.00	6146B/8298	10.50	8643	83.00
4CX350F/8322	115.00	6146W/7212	17.95	8647	168.00
4CX350FJ/8904	140.00	6156	110.00	8683	95.00
4CX600J/8809	835.00	6159	13.85	8877	465.00
4CX1000A/8168	242.50*	6159B	23.50	8908	13.00
4CX1000A/8168	485.00	6161	325.00	8950	13.00
4CX1500B/8660	555.00	6280	42.50	8930	137.00
4CX5000A/8170	1100.00	6291	180.00	6L6 Metal	25.00
4CX10000D/8171	1255.00	6293	24.00	6L6GC	5.03
4CX15000A/8281	1500.00	6326	P.O.R.	6CA7/EL34	5.38
4CW800F	710.00	6360/A	5.75	6CL6	3.50
4D32	240.00	6399	540.00	6DJ8	2.50
4E27A/5-125B	240.00	6550A	10.00	6DQ5	6.58
4PR60A	200.00	6883B/8032A/8552	10.00	6GF5	5.85
4PR60B	345.00	6897	160.00	6GJ5A	6.20
4PR65A/8187	175.00	6907	79.00	6GK6	6.00
4PR1000A/8189	590.00	6922/6DJ8	5.00	6HB5	6.00
4X150A/7034	60.00	6939	22.00	6HF5	8.73
4X150D/7609	95.00	7094	250.00	6JG6A	6.28
4X250B	45.00	7117	38.50	6JM6	6.00
4X250F	45.00	7203	P.O.R.	6JN6	6.00
4X500A	412.00	7211	100.00	6JS6C	7.25
5CX1500A	660.00	7213	300.00*	6KN6	5.05
KT88	27.50	7214	300.00*	6KD6	8.25
416B	45.00	7271	135.00	6LF6	7.00
416C	62.50	7289/2C39	34.00	6LQ6 G.E.	7.00
572B/T160L	49.95	7325	P.O.R.	6LQ6/6MJ6 Sylvania	9.00
592/3-200A3	211.00	7360	13.50	6ME6	8.90
807	8.50	7377	85.00	12AT7	3.50
811A	15.00	7408	2.50	12AX7	3.00
812A	29.00	7609	95.00	12BY7	5.00
813	50.00	7735	36.00	12JB6A	6.50

NOTE * = USED TUBE

NOTE P.O.R. = PRICE ON REQUEST

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MOTOROLA	4884863B01	11.7MHz 2pole 15KHz bandwidth	5.00
PTI	5350C	12MHz 2pole 15KHz bandwidth	5.00
PTI	5426C	21.4MHz 2pole 15KHz bandwidth	5.00
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MURATA	BFB455B	455KHz	2.50
	BFB455L	455KHz	3.50
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	CFM455D	455KHz +-7KHz at 3dB , +-10KHz at 6dB , +-20KHz at 50dB	6.65
	CFR455E	455KHz +-5.5KHz at 3dB , +-8KHz at 6dB , +-16KHz at 60dB	8.00
	CFU455B	455KHz +-2KHz bandwidth +-15KHz at 6dB, +-30KHz at 40dB	2.90
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	CFU455G	455KHz +-1KHz bandwidth +-4.5KHz at 6dB , +-10KHz at 40dB	2.90
	CFU455H	455KHz +-1KHz bandwidth +-3KHz at 6dB , +-9KHz at 40dB	2.90
	CFU455I	455KHz +-1KHz bandwidth +-2KHz at 6dB , +-6KHz at 40dB	2.90
	CFW455D	455KHz +-10KHz at 6dB , +-20KHz at 40dB	2.90
	CFW455H	455KHz +-3KHz at 6dB , +-9KHz at 40dB	2.90
	SFB455D	455KHz	2.50
	SFD455D	455KHz +-2KHz , 3dB bandwidth 4.5KHz +-1KHz	5.00
	SFE10.7MA	10.7MHz 280KHz +-50KHz at 3dB , 650KHz at 20dB	2.50
	SFE10.7MS	10.7MHz 230KHz +-50KHz at 3dB , 570KHz at 20dB	2.50
	SFG10.7MA	10.7MHz	10.00
NIPPON	LF-B4/CFU455I	455KHz +-1KHz	2.90
	LF-B6/CFU455H	455KHz +-1KHz	2.90
	LF-B8	455KHz	2.90
	LF-C18	455KHz	10.00
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2N1692	25.00	2N5922	10.00	40894 RCA	1.00	BLX67	12.25
2N2857	1.55	2N5923	25.00	60247 RCA	25.00	BLX67C3	12.25
2N2857JAN	4.10	2N5941	23.00	61206 RCA	100.00	BLX93C3	22.21
2N2857JANTX	4.50	2N5942	40.00	62800A RCA	60.00	BLY87A	7.50
2N2876	13.50	2N5944	10.35	62803 RCA	100.00	BLY88C3	13.08
2N2947	18.35	2N5945	10.00	430414/3990RCA	50.00	BLY89C	13.00
2N2948	13.00	2N5946	12.00	3457159 RCA	20.00	BLY90	45.00
2N2949	15.50	2N5947	9.20	3729685-2 RCA	75.00	BLY92	13.30
2N3118	5.00	2N6080	6.00	3729701-2 RCA	50.00	BLY94C	45.00
2N3119	4.00	2N6081	7.00	3753883 RCA	50.00	BLY351	10.00
2N3134	1.15	2N6082	9.00	615467-902	25.00	BLY568C/CF	30.00
2N3287	4.90	2N6083	9.50	615467-903	40.00	C2M70-28R	92.70
2N3288	4.40	2N6084	12.00	2SC568	2.50	C25-28	57.00
2N3309	4.85	2N6094	11.00	2SC703	36.00	C4005	2.50
2N3375	17.10	2N6095	12.00	2SC756A	7.50	CD1659	20.00
2N3478	2.13	2N6096	16.10	2SC781	2.80	CD1899	20.00
2N3553	1.55	2N6097	20.70	2SC1018	1.00	CD1920	10.00
2N3553JAN	2.90	2N6105	21.00	2SC1042	24.00	CD2188	18.00
2N3632	15.50	2N6136	21.85	2SC1070	2.50	CD2545	24.00
2N3733	11.00	2N6166	40.24	2SC1216	2.50	CD2664A	16.00
2N3818	5.00	2N6267	142.00	2SC1239	2.50	CD3167	92.70
2N3866	1.30	2N6304	1.50	2SC1251	24.00	CD3353	95.00
2N3866JAN	2.20	2N6368	30.00	2SC1306	2.90	CD3435	26.30
2N3866JANTX	3.80	2N6439	55.31	2SC1307	5.50	CD3900	152.95
2N3866JANTXV	4.70	2N6459	18.00	2SC1424	2.80	CM25-12	20.00
2N3866AJANTXV	5.30	2N6567	10.06	2SC1600	5.00	CM40-12	27.90
2N3924	3.35	2N6603	13.50	2SC1678	2.00	CM40-28	56.90
2N3926	16.10	2N6604	13.50	2SC1729	32.40	CME50-12	30.00
2N3927	17.25	2N6679	44.00	2SC1760	1.50	CTC2001	42.00
2N3948	1.75	2N6680	80.00	2SC1909	4.00	CTC2005	55.00
2N3950	25.00	021-1	15.00	2SC1945	10.00	CTC3005	70.00
2N3959	3.85	01-80703T4	65.00	2SC1946	40.00	CTC3460	20.00
2N4012	11.00	35C05	15.00	2SC1947	10.00	DV2820S	25.00
2N4037	2.00	102-1	28.00	2SC1970	2.50	DXL1003P70	22.00
2N4041	14.00	103-1	28.00	2SC1974	4.00	DXL2001P70	19.00
2N4072	1.80	103-2	28.00	2SC2166	5.50	DXL2002P70	14.00
2N4080	4.53	104P1	18.00	2SC2237	32.00	DXL3501AP100F	47.00
2N4127	21.00	163P1	10.00	2SC2695	47.00	EFJ4015	12.00
2N4416	2.25	181-3	15.00	A2X1698	POR	EFJ4017	24.00
2N4427	1.25	210-2	10.00	A3-12	14.45	EFJ4021	24.00
2N4428	1.85	269-1	18.00	A50-12	24.00	EFJ4026	35.00
2N4430	11.80	281-1	15.00	A209	10.00	EN15745	20.00
2N4927	3.90	282-1	30.00	A283	6.00	FJ9540	16.00
2N4957	3.45	482	7.50	A283B	6.00	FSX52WF	58.00
2N4959	2.30	564-1	25.00	A1610	19.00	G65739	25.00
2N5016	18.40	698-3	15.00	AF102	2.50	G65386	25.00
2N5026	15.00	703-1	15.00	AFY12	2.50	GM0290A	2.50
2N5070	18.40	704	4.00	AR7115	20.00	HEP76	4.95
2N5090	13.80	709-2	11.00	AT41435-5	6.35	HEPS3002	11.40
2N5108	3.45	711	4.00	B2-8Z	10.70	HEPS3003	30.00
2N5109	1.70	733-2	15.00	B3-12	10.85	HEPS3005	10.00
2N5160	3.45	798-2	25.00	B12-12	15.70	HEPS3006	19.90
2N5177	21.62	3421	28.00	BAL0204125	152.95	HEPS3007	25.00
2N5179	1.04	3683P1	15.00	BF25-35	56.25	HEPS3010	11.34
2N5216	56.00	3992	25.00	B40-12	19.25	HF8003	10.00
2N5470	75.00	4164P1	15.00	B70-12	55.00	HFET2204	112.00
2N5583	3.45	4243P1	28.00	BF272A	2.50	HP35821	38.00
2N5589	9.77	4340P3	18.00	BFQ85	2.50	HP35826B	32.00
2N5590	10.92	4387P1	27.50	BFR21	2.50	HP35826E	32.00
2N5591	13.80	7104-1	28.00	BFR90	1.00	HP35831E	30.00
2N5596	99.00	7249-2	10.50	BFR91	1.65	HP35832E	50.00
2N5636	12.00	7283-1	37.50	BFR99	2.50	HP35833E	50.00
2N5637	15.50	7536-1	30.00	BFT12	2.50	HP35859E	75.00
2N5641	12.42	7794-1	10.50	BFW16A	2.50	HP35866E	44.00
2N5642	14.03	7795	15.00	BFW17	2.50	HXTR2101	44.00
2N5643	25.50	7795-1	15.00	BFW92	1.50	HXTR3101	7.00
2N5645	13.80	7796-1	24.00	BFX44	2.50	HXTR5101	31.00
2N5646	20.70	7797-1	36.00	BFX48	2.50	HXTR6104	68.00
2N5651	11.05	40081 RCA	5.00	BFX65	2.50	HXTR6105	31.00
2N5691	18.00	40279 RCA	10.00	BFX84	2.50	HXTR6106	33.00
2N5764	27.00	40280 RCA	4.62	BFX85	2.50	J310	1.00
2N5836	3.45	40281 RCA	10.00	BFX86	2.50	J02000	10.00
2N5842	8.45	40282 RCA	20.00	BFX89	1.00	J02001	25.00
2N5847	19.90	40290 RCA	2.80	BFY11	2.50	J04045	24.00
2N5849	20.00	40292 RCA	13.05	BFY18	2.50	KD5522	25.00
2N5913	3.25	40294 RCA	2.50	BFY19	2.50	KJ5522	25.00
2N5916	36.00	40341 RCA	21.00	BFY39	2.50	M1106	13.75

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M1131	5.15	MRF464	25.30	NE021350	5.30	SD1009-2	15.00
M1132	7.25	MRF466	18.97	NE13783	61.00	SD1012	10.00
M1134	13.40	MRF472	1.50	NE21889	43.00	SD1012-3	10.00
M9116	29.10	MRF475	3.10	NE57835	5.70	SD1012-5	10.00
M9579	6.00	MRF476	3.16	NE64360ER-A	100.00	SD1013	10.00
M9580	7.95	MRF477	20.00	NE64480 (B)	94.00	SD1013-3	10.00
M9587	7.00	MRF479	8.05	NE73436	2.50	SD1013-7	10.00
M9588	5.20	MRF492	23.00	NE77362ER	100.00	SD1016	15.00
M9622	5.95	MRF502	1.04	NE98260ER	100.00	SD1016-5	15.00
M9623	7.95	MRF503	6.00	PRT8637	25.00	SD1018-4	13.00
M9624	9.95	MRF504	7.00	PT3127A	5.00	SD1018-6	13.00
M9625	15.95	MRF509	5.00	PT3127B	5.00	SD1018-7	13.00
M9630	14.00	MRF511	10.69	PT3127C	20.00	SD1018-15	13.00
M9740	27.90	MRF515	2.00	PT3127D	20.00	SD1020-5	10.00
M9741	27.90	MRF517	2.00	PT3127E	20.00	SD1028	15.00
M9755	16.00	MRF525	3.45	PT3190	20.00	SD1030	12.00
M9780	5.50	MRF559	1.76	PT3194	20.00	SD1030-2	12.00
M9827	11.00	MRF587	11.00	PT3195	20.00	SD1040	5.00
M9848	35.00	MRF605	20.00	PT3537	7.80	SD1040-2	20.00
M9850	13.50	MRF618	25.00	PT4166E	20.00	SD1040-4	10.00
M9851	20.00	MRF626	12.00	PT4176D	25.00	SD1040-6	5.00
M9860	8.25	MRF628	8.65	PT4186B	5.00	SD1043	12.00
M9887	2.80	MRF629	3.45	PT4209	25.00	SD1043-1	10.00
M9908	6.95	MRF641	25.30	PT4209C/5645	25.00	SD1045	3.75
M9965	12.00	MRF644	27.60	PT4556	24.60	SD1049-1	2.00
MM1500	25.00	MRF646	29.90	PT4570	7.50	SD1053	4.00
MM1550	10.00	MRF648	33.35	PT4577	20.00	SD1057	10.00
MM1552	50.00	MRF816	15.00	PT4590	5.00	SD1065	4.75
MM1553	50.00	MRF823	20.00	PT4612	20.00	SD1068	15.00
MM1607	8.45	MRF846	44.85	PT4628	20.00	SD1074-2	18.00
MM1614	10.00	MRF892	35.50	PT4640	20.00	SD1074-4	28.00
MM1810	15.00	MRF894	46.00	PT4642	20.00	SD1074-5	28.00
MM1810	15.00	MRF901 3 Lead	1.00	PT5632	4.70	SD1076	18.50
MM1943	1.80	MRF901 4 Lead	2.00	PT5749	25.00	SD1077	4.00
MM2608	5.00	MRF902/2N6603JAN	15.00	PT6612	25.00	SD1077-4	4.00
MM3375A	17.10	MRF902B	18.40	PT6619	20.00	SD1077-6	4.00
MM4429	10.00	MRF904	2.30	PT6708	25.00	SD1078-6	24.00
MM8000	1.15	MRF905	2.55	PT6709	25.00	SD1080-7	7.50
MM8006	2.30	MRF911	2.50	PT6720	25.00	SD1080-8	6.00
MM8011	25.00	MRF965	2.55	PT8510	15.00	SD1080-9	3.00
MPSU31	1.01	MRF966	3.55	PT8524	25.00	SD1084	8.00
MRA2023-1.5	42.50	MRF1000MA	32.77	PT8609	25.00	SD1087	15.00
MRF134	10.50	MRF1004M	31.05	PT8633	25.00	SD1088	22.00
MRF136	16.00	MRF2001	41.74	PT8639	25.00	SD1088-8	22.00
MRF171	35.00	MRF2005	54.97	PT8659	25.00	SD1089-5	15.00
MRF208	11.50	MRF5176	24.00	PT8679	25.00	SD1090	15.00
MRF212	16.10	MRF8004	2.10	PT8708	20.00	SD1094	15.00
MRF221	10.00	MSC1720-12	225.00	PT8709	20.00	SD1095	15.00
MRF223	13.00	MSC1821-3	125.00	PT8727	29.00	SD1098-1	30.00
MRF224	13.50	MSC1821-10	225.00	PT8731	25.00	SD1100	5.00
MRF227	3.45	MSC2001	30.00	PT8742	19.10	SD1109	18.00
MRF230	2.00	MSC2010	93.00	PT8787	25.00	SD1115-2	7.50
MRF231	10.00	MSC2223-10	245.00	PT8828	25.00	SD1115-3	7.50
MRF232	12.07	MSC2302	POR	PT9700	25.00	SD1115-7	2.10
MRF237	3.15	MSC3000	35.00	PT9702	25.00	SD1116	5.00
MRF238	13.80	MSC3001	38.00	PT9783	16.50	SD1118	22.00
MRF239	17.25	MSC72002	POR	PT9784	32.70	SD1119	5.00
MRF245	35.65	MSC73001	POR	PT9790	56.00	SD1124	50.00
MRF247	31.00	MSC80064	35.00	PT31083	20.00	SD1132-1	15.00
MRF304	36.00	MSC80091	10.00	PT31962	20.00	SD1132-4	12.00
MRF306	50.00	MSC80099	3.00	PTX6680	20.00	SD1133	9.50
MRF313	11.15	MSC80593	POR	RE3754	25.00	SD1133-1	10.00
MRF314	29.21	MSC80758	POR	RE3789	25.00	SD1134-1	2.50
MRF315	28.86	MSC82001	33.00	RF35	16.00	SD1134-4	12.00
MRF316	55.43	MSC82014	33.00	RF85	17.50	SD1134-17	12.00
MRF317	63.94	MSC82020M	130.00	RF110	21.00	SD1135	10.25
MRF412	18.00	MSC82030	33.00	S50-12	23.80	SD1135-3	12.00
MRF420	20.12	MSC83001	40.00	S3006	15.00	SD1136	12.50
MRF421	25.00	MSC83003	82.00	S3007	10.00	SD1136-2	12.50
MRF422	38.00	MSC83005	70.00	S3031	22.00	SD1143-1	10.00
MRF427	17.25	MSC83026	POR	SCA3522	5.00	SD1143-3	17.00
MRF428	63.00	MSC83303	POR	SCA3523	5.00	SD1144	4.00
MRF433	12.07	MSC84900	60.00	SD345	5.00	SD1145-5	15.00
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MRF453/A	18.40	MT5768(2N)	95.00	SD1007-2	15.00	SD1189	24.00
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SD1212-8	4.95	SD1305	3.00	SD1452	20.00	SRF1431	40.00	SD1262	15.00	SD1413-1	18.00	SD1539H	100.00	SRF2918	15.00
SD1212-11	4.95	SD1307	3.00	SD1452-4	24.00	SRF1834	40.00	SD1263	15.00	SD1416	28.00	SD1542H1	170.00	SRF2919	15.00
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SD1214-7	5.00	SD1311	1.00	SD1454-1	48.00	SRF2092	50.00	SD1272	10.95	SD1428	24.00	SD1545	33.00	SS4006	25.00
SD1214-11	5.00	SD1317	8.00	SD1477	35.00	SRF2147	22.00	SD1272-1	10.95	SD1428- 6084	12.00	SD1546H1	55.00	SS4152	15.00
SD1216	12.00	SD1319	2.50	SD1478	21.00	SRF2225	15.00	SD1272-2	10.95	SD1429-2	15.00	SD1561	79.00	TA7686	15.00
SD1219-4	15.00	SD1345-6	5.00	SD1480	53.00	SRF2264	25.00	SD1272-4	10.95	SD1429-3	14.90	SD1574-1	6.95	TA8559	15.00
SD1219-5	15.00	SD1347-1	1.00	SD1484	1.50	SRF2265	100.00	SD1278	13.75	SD1429-5	15.00	SD1575	6.95	TA8561	15.00
SD1219-8	15.00	SD1365-1	2.50	SD1484-5	1.50	SRF2281	5.00	SD1278-1	13.75	SD1430	12.00	SP4557	25.00	TA8562	15.00
SD1220	8.00	SD1365-5	2.50	SD1484-6	1.50	SRF2371	15.00	SD1278-5	13.75	SD1430-2	18.00	SK3048	5.00	TA8563	15.00
SD1220-1	9.50	SD1375	7.50	SD1484-7	1.50	SRF2347	50.00	SD1279-1	18.00	SD1434	28.00	SL501-59	15.00	TA8564	15.00
SD1220-9	8.00	SD1375-6	7.50	SD1488	22.85	SRF2356	38.00	SD1279-3	18.00	SD1434-5	28.00	SL501-173	15.00	TA8894	15.00
SD1222-8	16.00	SD1379	15.00	SD1488-1	28.00	SRF2378	16.00	SD1281-2	8.00	SD1434-9	28.00	SM7716	5.00	TIS189	3.35
SD1222-11	7.50	SD1380-1	1.00	SD1488-7	27.00	SRF2572	25.00	SD1283	10.00	SD1438	26.00	SRF112	15.00	TP312	2.50
SD1224-10	18.00	SD1380-3	1.00	SD1488-8	28.00	SRF2584	40.00	SD1283-2	10.60	SD1441	56.00	SRF395	50.00	TP1014	5.00
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SD1229-7	10.95	SD1408	25.00	SD1520-2	18.00	SRF2747	40.00	SD1289-1	15.00	SD1444-8	3.25	SRF8878Z3	2.50	TXVP2201/HP	450.00
SD1229-16	10.95	SD1409	18.00	SD1522-4	33.00	SRF2767M	40.00	SD1290-4	15.00	SD1444-9	3.25	SRF909K	15.00	V222-2	25.00
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SD1244-1	14.00	SD1410-6	21.00	SD1530-2	38.00	SRF2857	20.00	SD1301-7	3.00	SD1451	15.00	SRF1074	50.00		

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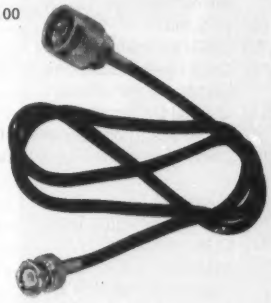

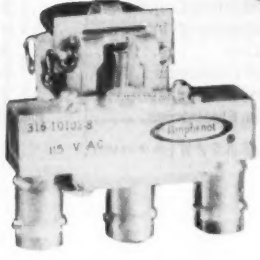

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PRICES: Prices are subject to change without notice.

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A. What is your specific interest in the items circled at right?
- ☐ 1. Immediate purchase
- ☐ 2. Purchase within 6 months
- ☐ 3. Brand comparisons
- ☐ 4. Reference
- ☐ 5. Other

B. How many projects from 73 have you built within the last year?
- ☐ 1. None
- ☐ 2. 1–2
- ☐ 3. 3–4
- ☐ 4. 5 or more

C. What is your most useful source of information about the equipment you buy?
- ☐ 1. Magazine review
- ☐ 2. New product announcement
- ☐ 3. Manufacturer's brochure
- ☐ 4. Dealer's advertisement

D. Which of the following 73 features do you read regularly?
- ☐ 1. Never Say Die
- ☐ 2. 73 International
- ☐ 3. New Products
- ☐ 4. Review
- ☐ 5. RTTY Loop
- ☐ 6. Fun!
- ☐ 7. Contests
- ☐ 8. DX
- ☐ 9. Awards
- ☐ 10. QRX...
- ☐ 11. Satellites
- ☐ 12. Propagation
- ☐ 13. Barter 'N' Buy
- ☐ 14. Letters

E. If you own a Commodore 64 or VIC 20 computer do you read any of the following magazines regularly?
- ☐ 1. RUN
- ☐ 2. Compute!'s Gazette
- ☐ 3. Compute!
- ☐ 4. Ahoy
- ☐ 5. Family Computing

F. If you own a TRS-80 computer, do you read any of the following magazines regularly?
- ☐ 1. 80 Micro
- ☐ 2. HOT CoCo
- ☐ 3. Rainbow

G. If you own an Apple computer, do you read any of the following magazines regularly?
- ☐ 1. inCider
- ☐ 2. A+
- ☐ 3. Nibble
- ☐ 4. Call A.P.P.L.E.

H. Do you:
- ☐ 1. Read 73 only
- ☐ 2. Read other amateur radio magazines as well

I. Which of the following microcomputers do you use in the hamshack?
- ☐ 1. Apple
- ☐ 2. VIC-20
- ☐ 3. Commodore 64
- ☐ 4. TRS-80 Color Computer
- ☐ 5. Other TRS-80 Models
- ☐ 6. Timex/Sinclair
- ☐ 7. CP/M-based

J. What type of information would you like to see in 73? (Pick 3)
- ☐ 1. Construction—gadgets
- ☐ 2. Construction—complex projects
- ☐ 3. Computer interfacing/RTTY
- ☐ 4. Satellites
- ☐ 5. Electronics tutorials
- ☐ 6. Antennas
- ☐ 7. Digital Communications

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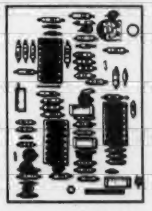

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ANNIVERSARY OF THE BATTLES OF KWAJALEIN AND ROI-NAMUR
Starts: 0600 UTC February 1
Ends: 0600 UTC February 9

KX6BU will again be on the air commemorating the 41st anniversary of the battles of Kwajalein and Roi-Namur. Frequencies will be 28.600, 21.350, and 14.250 on SSB, plus 28.050, 21.050, 14.050, and 7.050 on CW. Stations working KX6BU will be issued a QSL certificate for $3, or a 64-page book of the Battles of Kwajalein and Roi-Namur will be included for $6. All requests should be sent to KX6BU, Box 444, APO SF 96555-0008.

WAKI, the Worked all Kwajalein Award, is still available to any station that has confirmed five KX6 stations located on Kwajalein Atoll, including Kwajalein, Ebeye, and Roi-Namur islands. Anyone desiring a WAKI certificate should send a list certified by a club official containing the callsign, band, mode, and date worked. Send the list to KARC secretary, PO Box 444, APO San Francisco 96555-0008, along with $5.

VERMONT QSO PARTY
Starts: 0001 UTC February 2
Ends: 2400 UTC February 3

Sponsored by the Central Vermont Amateur Radio Club (W1BD). Each station may be contacted once on each band and mode (CW, phone, RTTY). CW and RTTY contacts must be in the CW and RTTY subbands. Duplicate and repeater contacts are invalid.

EXCHANGE:

RS(T) and state, province, country, or two-letter designator for VT county (AD, BN, CA, CN, EX, FN, GI, LA, OG, OL, RU, WA, WM, and WR).

FREQUENCIES:

Phone—3.910, 7.230, 14.260, 14.320, 21.360, 28.570, 50.110, 144.200; CW—3.540, 3.720, 7.040, 7.120, 14.040, 21.040, 21.140, 28.040; RTTY—3.620 and 90 kHz from lower edge of other RTTY subbands.

SCORING:

Score one point per phone contact, 5 points per CW or RTTY contact. VT stations multiply QSO points by number of VT counties plus states plus Canadian provinces plus ARRL countries (exclude US/Canada). Others multiply QSO points by the number of VT counties (14 max.). Add 20 bonus points for working W1BD.

AWARDS:

For non-VT stations, certificate to highest scoring station in each state, province, and country. Certificates will be awarded to each VT station submitting a log, and a plaque will be given to the highest scoring VT station. WVT Award will be given to stations working 13 of Vermont's 14 counties.

ENTRIES:

Send an SASE for the official log and score sheets. Send logs/facsimilies, name, class of license, and address—not later than March 1st—to: D. Nevin KK1U, W. Hill, Northfield VT 05663. Include an SASE for a copy of the results.

NEW HAMPSHIRE QSO PARTY
1900 UTC February 2 to 0700 UTC February 3
1400 UTC February 3 to 0200 UTC February 4

Sponsored by the NH Amateur Radio Association. Stations may be worked once per band and mode. NH stations may work each other.

EXCHANGE:

Send RS(T) and country, state, VE province, or NH county.

FREQUENCIES:

Phone—1.875, 3.975, 7.235, 14.280, 21.380, 28.575, 50.115, 145.205; CW—1.810, 3.555, 7.055, 14.055, 21.055, 28.055; Novice—3.730, 7.130, 21.130, 28.130; RTTY—3.625, 7.085, 14.085, 21.085, 28.085.

SCORING:

NH stations score 1 point per QSO, multiplied by the number of states (except NH) plus countries (except US, Canada, Alaska, and Hawaii) plus NH counties. Others score 5 points per NH QSO times the number of NH counties worked (10 maximum). In addition, all stations count 20 bonus points each for working the following NHARA member club stations: WB1CAG, W1OC, WB1FFZ, K1RD, and W1WQM, for a maximum of 100 bonus points.

AWARDS:

Certificates will be awarded to the highest scorer with a minimum of 5 QSOs in each NH county and state, province, and DXCC country. A plaque will be given to the highest scorer in NH courtesy of the Concord Brasspounders. A Worked All NH Award, sponsored by W1JB, will be given to participants who work all 10 NH counties.

ENTRIES:

Send your entry no later than March 15, 1985, to: Great Bay Radio Association, PO Box 911, Dover NH 03280. Include a large SASE for results.

DUTCH PACC CONTEST
Starts: 1200 UTC February 9
Ends: 1200 UTC February 10

Use all bands, 160 through 10 meters, on CW and SSB. No crossmode operation allowed. Each station may be worked only once per band regardless of mode. Operating categories include single operator, multi-operator, and SWL.

EXCHANGE:

RS(T) plus sequential QSO serial number starting with 001. Dutch stations will send their two-letter province abbreviation instead of a QSO number (GR, FR, DR, OV, GO, UT, YP, NH, ZH, ZL, NB, and LB).

SCORING:

Each QSO with PA, PB, or PI counts one point. Multiply QSO points by the number of provinces worked on each band (6 × 12 = 72 max.).

SWLs count one point per Dutch station heard and multiply by provinces heard on each band (72 max.).

ENTRIES:

As usual, a score calculation is required. Please use a multiplier column and insert multipliers only if a new one. A log must be signed for observation of the contest rules. SWL logs must contain code groups given by the Dutch station and the foreign station worked. Send logs not later than March 31, 1985 to: PA0INA, F. Th. Oosthoek, PO Box 499, 4600 AL Bergen op Zoom, Netherlands.

A certificate will be awarded to the winner in each country in each category along with the second- and third-place stations, provided that there are sufficient participants in that country. Certificates will also go to winners in each call district of JA, LU, PY, UA9/0, VE/VO, VK, W, ZL, and ZS.

	QSOs	Points
K1KI	216	9,288
K2SX	66	1,386
W3ARK	117	2,340
N4MM	78	1,638
KN6O	4	12
K8PYD	42	756

The US call district winners in last year's Dutch PACC Contest.

YL-ISSB COMMO SYSTEM QSO PARTY—PHONE
Starts: 0001 UTC February 23
Ends: 2359 UTC February 24

Use the General-class band portion on all HF bands and simplex-only contacts on all VHF bands. Individuals needing applications and instruction forms can send a 4 × 9 SASE to K0RDJ and NA0V, Rick and Minnie Connolly, Star Route 1, Crocker MO 63452. They *do not* furnish log forms.

CALENDAR

Feb 2-3	Vermont QSO Party
Feb 2-4	New Hampshire QSO Party
Feb 9-10	Dutch PACC Contest
Feb 16-17	ARRL DX Contest—CW
Feb 23	RTTY World Championship
Feb 23-24	YL-ISSB Commo System QSO Party—Phone
Mar 2-3	ARRL DX Contest—Phone
Mar 16-17	YL-ISSB Commo System QSO Party—CW
Mar 16-17	Spring QRP CW Activity Weekend
Mar 16-17	Bermuda Amateur Radio Contest
Mar 30-31	Rio CW DX Party
Apr 20-21	World Fishing Contest—Vigo '85
Apr 27-28	Helvetia Contest
Jun 8-9	Worldwide South America CW Contest
Jun 8-9	ARRL VHF QSO Party
Jun 22-23	ARRL Field Day
Jul 1	CARF Canada Day Contest
Jul 13-14	IARU Radiosport Championship
Jul 20-22	CQ VHF WPX Contest
Aug 3-4	ARRL UHF Contest
Aug 17-18	New Jersey QSO Party
Sep 14-15	ARRL VHF QSO Party
Sep 28-29	Late Summer QRP CW Activity Weekend
Oct 5-6	ARRL QSO Party—CW
Oct 12-13	Rio CW DX Contest
Oct 12-13	ARRL QSO Party—Phone
Oct 19-20	ARRL Simulated Emergency Test
Nov 2-3	ARRL Sweepstakes—CW
Nov 16-17	ARRL Sweepstakes—Phone
Dec 14-15	ARRL 10-Meter Contest

THE ARUNDEL HAM NEWS

AARC

NEWSLETTER OF THE MONTH

The Ham Arundel News, edited by Holly Bevan N3BMB and Di Helfrich KA3GWI, takes this month's honors. The *News* chronicles the activities of the Anne Arundel Radio Club, located in Davidsonville, Maryland.

And what activity! I was impressed with the variety of things that the club's members are involved in. Community service, contests, traffic handling; they're all well represented by this group. Several nets during the week on various bands and modes keep everyone's skills honed and add to a feeling of camaraderie that is evident throughout the pages of the *News*.

The newsletter offers a wealth of information from diverse sources in a well presented format. It's obvious that Holly and Di have great pride in their work. Club President Ron Nord N3AKP should take every precaution necessary to ensure that these two stay on the job.

To enter your club's newsletter in 73's Newsletter of the Month Contest, send it to *73*, Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

Kantronics UTU Solves Your Compatibility Problems

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Now, with **UTU**, any computer with an RS232 port and a terminal program can interface with any transceiver. Because of an internal microcomputer, UTU requires no additional decoding software. A short terminal program is used to link the computer to UTU. Sample programs for IBM, Kaypro, TRS-80 Models III & IV are included in UTU's manual. UTU offers the following features:

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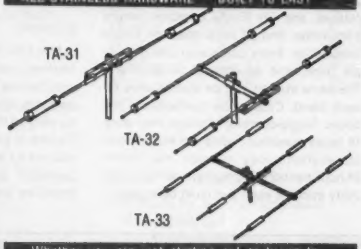
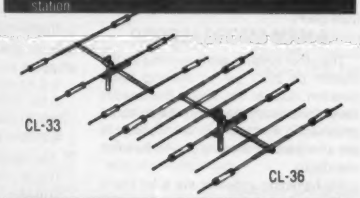


Whether you are just starting out or trying to complete the Honor Roll, Mosley offers a Full Line of Tri-Banders which will mechanically and electronically outperform the competition. For the new ham with limited space and pocket book, start with our TA-31 Jr. rotatable dipole. You can make our TA-31 Jr. into a 2 or 3 element as your needs increase.
If you start with the need to run higher power, then the TA-31 is for you. This also can be made into a 2 or 3 element beam as you expand your station.



For the ham that wants a little more performance out of a Tri-Bander but is limited in room, then our CL-33 on a 18 foot boom is the way to go. For those that want MONO BAND performance out of a Tri-Bander, want to hear better, and be louder, the CL-36 is for you.

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↙ See List of Advertisers on page 80

4TH ANNUAL RTTY WORLD CHAMPIONSHIP

Starts: 0000 UTC February 23
Ends: 2400 UTC February 23

The contest is sponsored by *The RTTY Journal* and by *73*. The two operator classes are: (A) single operator, single transmitter, and (B) multi-operator, single transmitter. Entry categories are: (A) single band, and (B) allband, 10–80meters. The same station may be worked once on each band. Crossmode contacts do not count. Single-operator stations may work 16 hours maximum, while the multi-operator stations may operate the entire 24-hour period. Off times are no less than thirty minutes each and must be logged.

EXCHANGE:

Stations within the continental US and Canada must transmit RST and state, province, or territory. All others must transmit RST and consecutive contact number.

SCORING:

Five QSO points for contacts with W/VE stations located within the continental US and Canada. Ten QSO points for all other contacts. One multiplier point is awarded for each of the 48 continental US states (a District of Columbia contact may be substituted for a state of Maryland multiplier), Canadian provinces/territories, and DX countries worked on each band (excluding US and Canada). Total QSO points times total multipliers equals claimed score.

AWARDS:

Contest awards will be issued in each entry category and operator class in each of the US call districts, Canadian provinces/territories, as well as in each DX country represented. Other awards may be issued at the discretion of the awards committee. A minimum of 25 QSOs must be worked to be eligible for awards.

ENTRIES:

Entries must include a separate log for each band, a dupe sheet, a multiplier checklist, and a list of equipment used. Contestants are asked to send an SASE to the contest address for official forms. Omission of the required entry forms, operating in excess of legal power, manipulating scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification. Decisions of the contest committee are final.

All entries must be postmarked no later than April 16, 1985, and should be sent to: RTTY World Championship Contest, c/o *The RTTY Journal*, PO Box RY, Cardiff CA 92077.

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

A HAM SMORGASBORD

The other evening, while working an SM station on 20, I got to thinking about Swedish cuisine. You know, the Swedes have some really wonderful ideas about good eating. Perhaps their best concept is the smorgasbord (second only to Swedish meatballs).

My hamming activities are a lot like a well-prepared smorgasbord, since I'm never content with sticking to just one or two of our hobby's numerous diversions. During my years as a ham I've been involved with DXing, CW, RTTY, SSTV, repeaters, VHF DXing, home-brew construction, emergency work, certificate hunting, and contesting, rarely sticking to one endeavor for more than a few months at a time. That's the great thing about our hobby: If you're the sort of person who has a limited attention span, there's always something new or different to catch your interest.

Which brings me back to the topic of smorgasbords. Writing a monthly column about a single topic within amateur radio can become stifling after a while. One yearns to break free, to write a column that covers the entire spectrum of amateur activities. And that's what I did this month, write a "Fun!" column with something for everyone. A ham smorgasbord, if you will. Enjoy—and good luck.

THE QUESTIONS

1) The first transatlantic QSO took place in:
1) 1901
2) 1912
3) 1918
4) 1923

2) In what year was the Vibroplex "bug" Company established?
1) 1885
2) 1890
3) 1904
4) 1920

3) Which of the following was never a recognized distress signal:
1) CQD
2) SOS
3) QRRR
4) CQE

4) The Top Band is:
1) 160 meters
2) 80 meters
3) 20 meters
4) 70 centimeters

5) Heathkit got its start by making:
1) radio kits
2) "fly it yourself" airplane kits
3) furniture
4) automobiles

6) Ionic scatter is useful over a range of about:
1) 0–50 miles
2) 50–500 miles
3) 600–1200 miles
4) 2000–5000 miles

7) Frequency synthesis:
1) was common in the 1960s
2) uses a variable capacitor
3) is outdated
4) uses digital techniques

8) The lower the frequency:
1) the shorter the antenna
2) the higher the antenna
3) the longer the antenna
4) the thicker the antenna wire

9) The *Popular Electronics* ham-radio columnist in the 1960s was:
1) Stan Burns W1XCT
2) Herb Brier W9EGQ
3) Tom Hanks WB2LWJ
4) Jim Bird WA2MJK

10) The first reciprocal operating agreement was reached with:
1) the United Kingdom
2) Canada
3) Costa Rica
4) Italy

11) About how many members did the ARRL have in 1914?
1) 50
2) 200
3) 2,000
4) 20,000

12) The FCC started issuing WA prefixes in:
1) 1951
2) 1957
3) 1960
4) 1967

13) Another name for a RTTY demodulator is a:
1) modem
2) Teletype®
3) converter
4) generator

14) A radio signal can travel no farther than:
1) 20,000 miles
2) 200,000 miles
3) 20,000,000 miles
4) infinity

15) Transequatorial propagation is usually found on:
1) VLF
2) HF
3) VHF
4) SHF

16) "See you on the green keys," is a saying used by:
1) computer hackers
2) RTTY buffs
3) SSTV enthusiasts
4) CW keyboard operators

17) In what year were Technician-class operators permitted to use 6 meters?
1) 1950
2) 1955
3) 1960
4) 1965

18) "Gray line" propagation is usually found:
1) on a bus
2) at night
3) at sunrise and sunset
4) during solar eclipses

19) Which of the following components is *not* used as a power-supply regulator?
1) integrated circuit
2) zener diode
3) resistor
4) transistor

20) Hallicrafters' popular HT-30 was unveiled in:
1) 1944
2) 1950
3) 1954
4) 1958

21) Which component *cannot* be tested by a volt ohmmeter?
1) integrated circuit
2) transistor
3) diode
4) resistor

22) The first amateur-radio organization—the Junior Wireless Club, Limited, of New York City—was founded in:
1) 1890
2) 1901
3) 1909
4) 1915

23) The US Post Office issued an amateur-radio stamp in:
1) 1934
2) 1954
3) 1964
4) 1974

24) Radio waves in a circuit act like:
1) ac
2) dc
3) FM
4) eddy pools

25) Before the mid-1970s, a "Novice gallon" was:
1) 50 Watts
2) 75 Watts
3) 250 Watts
4) 2 kilowatts

26) A shorting stick is a form of:
1) capacitor
2) resistor
3) transistor
4) safety device

27) A "brag tape" was used by:
1) RTTY operators
2) SSTV users
3) contesters
4) traffic handlers

28) The GERATOL Net:
1) meets on 20 meters
2) is open only to Extra-class hams
3) is only for old-timers
4) meets on Friday afternoons

29) The Coulomb is the unit of:
1) quality
2) quantity
3) inductance
4) capacitance

30) Arizona was once in the:
1) third call district
2) sixth call district
3) first call district
4) zero call district

31) New Jersey was once in the:
1) first call district
2) third call district
3) ninth call district
4) fifth call district

32) How many rectifiers does a full-wave bridge rectifier use?
1) one
2) two
3) three
4) four

33) Back in the 1960s, who used to "sign" every ham ticket?
1) John Q. Public
2) Robert G. Baxter
3) Harry Dannals
4) Ben F. Waple

34) Which of the following government agencies *never* administered amateur radio:
1) Navy Department
2) Federal Radio Commission
3) Army Department
4) Commerce Department

35) What is the current value of an 8-Watt lamp running at 200 volts?
1) 25
2) 0.4
3) 0.04
4) 0.004

36) The top limit for QRP (low-power) operation is usually considered to be:
1) 1 milliwatt
2) 5 milliwatts
3) 1 Watt
4) 5 Watts

37) "73" means:
1) good-bye
2) good luck
3) best regards
4) signing off

38) The 1947 World Administrative Radio Conference was held in:
1) Cairo
2) London
3) Geneva
4) Atlantic City

39) In the 1920s, the ARRL tried to change amateur radio's name to:
1) citizen radio
2) people's radio
3) hobbyist radio
4) technical radio

40) The Geminids meteor shower occurs in:
1) March
2) June
3) August
4) December

41) "Multipliers" are found:
1) in contests
2) in audio stages
3) while DXing
4) rarely

42) Canada adopted incentive licensing in:
1) 1947
2) 1952
3) 1965
4) 1972

43) The term "yagi" comes from:
1) the name of its inventor
2) "Y-match antenna gain impedance"
3) a derivation of "yogi"
4) out of nowhere

44) Lee De Forest invented the audion in:
1) 1900
2) 1906
3) 1915
4) 1920

45) Which of the following terms *is not* an abbreviation for universal coordinated time:
1) UTC
2) GMT
3) Z
4) X

46) The ARRL's Worked All States Award was introduced in:
1) 1928
2) 1936
3) 1948
4) 1957

47) The first ARRL 10-Meter Contest was held in:
1) 1934
2) 1956
3) 1965
4) 1973

48) The "Fun!" column made its debut in:
1) 1965
2) 1977
3) 1980
4) 1983

49) Colpitts oscillators work through:
1) capacitive feedback
2) capacitive strobe effect
3) capacitive amplification
4) capacitive deamplification

50) The Collins KWM 1 was introduced in:
1) 1935
2) 1948
3) 1957
4) 1963

THE ANSWERS

1—4	6—3	11—2
2—2	7—4	12—2
3—4	8—3	13—3
4—1	9—2	14—4
5—2	10—3	15—3
16—2	28—2	40—4
17—2	29—2	41—1
18—3	30—2	42—1
19—3	31—2	43—1
20—3	32—4	44—2
21—1	33—4	45—4
22—3	34—3	46—2
23—3	35—3	47—4
24—1	36—4	48—3
25—2	37—3	49—1
26—4	38—4	50—3
27—1	39—1	

SCORING

Two points for each correct answer.
How did you do?
1-20 points—Have you considered stamp collecting?
21-40 points—Take off the headset
41-60 points—So you like 2-meter FM?
61-80 points—Amateur material
81-100 points—A complete ham

HAM HELP

I need service information or parts for several pieces of equipment. I will copy the information and return it. Here's the list: EIP model 350C Auto Het frequency counter, 20 Hz to 12.4 GHz; Panasonic model RF2800 AM/FM/SW receiver (the AM section is dead; it needs a bandswitch and a whip antenna); Simpson model B 16-channel VHF transceiver; R. L. Drake R4B receiver; Midland model 13-955 CB; Lafayette model RK-825 reel-to-reel tape recorder. Thanks!

Mike Adams N4EVS
6333 Hwy. 2321
Panama City FL 32404

I would like to know the day, time, and frequency of the IBM PC Users' net on 20 meters.

Gail L. West WA4ASB
6605 SW 113 Ave.
Miami FL 33173

I recently purchased a Xerox model TC400 telecopier and would like to use it for weather-satellite reception and to receive facsimile signals from my shortwave radio. Unfortunately, the TC400 has a drum speed of 180 rpm, which is not compatible with the 120 rpm used in radio work. Has anyone successfully converted this unit to 120-rpm service?

Philip Nash
27 Highview Place
Kitchener, Ontario
Canada N2N 1W8

I am in search of a construction/alignment manual for the Conar model 255 oscilloscope. I will pay a reasonable price for the original or a photocopy.

Robert Whitted DA2EB
PO Box 2567
APO NY 09123

The Problem Solver...

The RF Wattmeter Model 81000-A from Coaxial Dynamics, Inc. does more than provide accurate rf measurements. Testing of transmission lines, antennas, connectors, filters and related components can reveal unknown problems and assure optimum equipment performance.

The 81000-AK Wattkit features this easy-to-read RF Wattmeter (pictured here), with its optional carrying case and an array of elements and accessories. Coaxial Dynamics elements can be purchased separately for use in other manufacturer's Wattmeters. For more information on the 81000-A Wattmeter or any of the complete line of Coaxial Dynamics RF products and OEM components please contact Coaxial Dynamics, Inc.

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See List of Advertisers on page 80

73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73: Amateur Radio's Technical Journal, *Pine Street, Peterborough NH 03458, USA, Attn: Perry Donham KW1O.*

AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

STOP PRESS—FIRST TIME EVER VI3 PREFIX

To celebrate Victoria's (VK3) 150 years of settlement, our WIA Executive applied to our DOC for a special callsign prefix, expecting to get the usual AX prefix. Everybody was elated when our DOC granted, for the first time ever, the use of the VI3WI callsign.

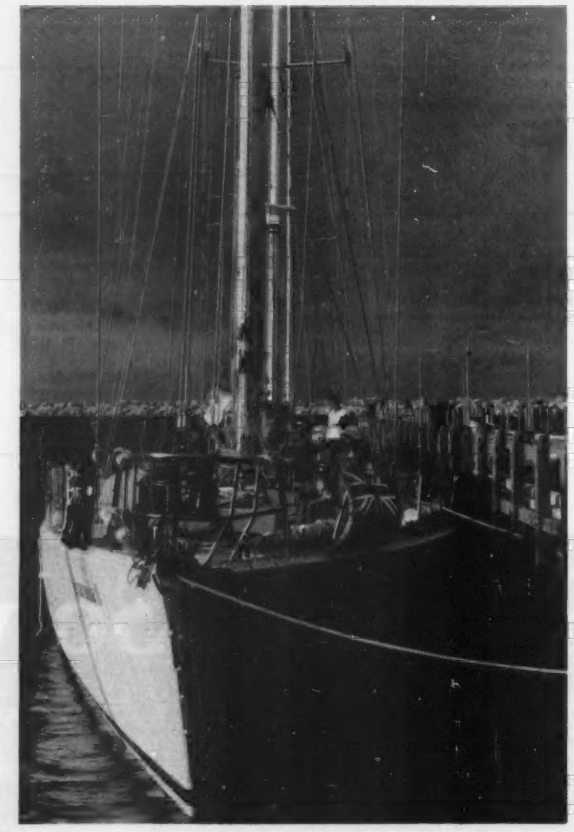
This should please the prefix hunters as it will be in use by selected clubs and individuals only and, to guarantee QSL cards, the WIA (VK3 Division) has taken on the QSLing for this special event. All contacts will receive a QSL card via the bureau and those wishing a direct card are being catered to also. The card itself will feature a special "Victoria Growing Together" logo.

The use of this special callsign is granted from November, 1984, until April, 1985, and there also is an award involved. (Details are in the November, 1984, issue of 73, page 90.) The address for either a direct QSL with appropriate IRCs (US$2.00) or the award is Vic 150 Years Award, c/o W.I.A., 412 Brunswick Street, Fitzroy 3065, Victoria, Australia.

BIG BEN—THE WHITE VOLCANO

Shown nationally in prime viewing time on our TV Channel 2 Network recently was the documentary film of the VK8-organized expedition to Heard Island. The title of this documentary was "The White Volcano."

Lots of articles have been written concerning the two expeditions to Heard Island, but nothing written could compare with this beautifully filmed documentary. It starts off as the expeditioners are boarding the yacht *Anaconda II* in Perth, West Australia. As the expeditioners are to form part of the crew, it shows the boat's owner/skipper, Josko Grubic, training them in all aspects of handling this magnificent yacht under all conditions—60-knot winds and massive southern ocean waves included.



The yacht Anaconda II.

Your first impression of Heard Island is of magnificent isolation, but the feeling of isolation disappears when the film shows the wreckage of what was an Australian Antarctic Research Station. Particularly piquant are shots of the leftover boiling pots of those "sealers" who, in the late 1800s, reduced the local seal population from millions down to virtual extinction. Penguins and sea birds were also virtually wiped out.

Landing and Operating

The method of landing equipment at Atlas Cove is of particular interest. They used "rubber-ducky" type boats and charged at the rock and pebble beach; when they hit the beach, one man would jump out and throw out all the gear he could before the next wave took them off the beach again.

With the howling gales that are virtually a daily occurrence on Heard Island, the shots of the people raising the amateur antennas were interesting, considering that the wind blew the tribander down and bent it shortly after erection.

There was some good footage of Dave Shaw VK3DHF/VK0HI and Al Fisher K8CW/VK0CW making their first contact from Heard Island. This was with Hugh VK6FS, with Hugh giving a short speech of thanks to the expeditioners and wishing them luck.

Some excellent film was shown of the climbers conquering "Big Ben," the White Volcano. One shot in particular shows that the last access to the top of Big Ben is through a tunnel leading upwards through the mountain. While all outside the tunnel is ice and snow, the inside walls of this tunnel are quite warm to the touch.

As this documentary has already been shown on some TV stations in Asia and Europe, it could soon be released for viewing in the USA. With this in mind, I personally recommend this film. Not only is it good viewing for the amateur-radio content to show how a DX expedition should be planned and carried out, but because it shows one of our seldom-filmed remote land masses.

With over 30,000 contacts logged by only two amateur-radio operators under adverse weather and band conditions, the expedition was very successful, as was the conquering of Big Ben by the mountain

The base at Atlas Cove, Heard Island. Note the Australian and American flags on the antenna.

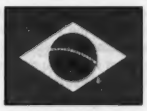
The tribander shortly after it went up: it was blown down. Again.

climbers, the scientists with the expedition also concluding their tests satisfactorily. Thus the VK6-sponsored expedition to Heard Island was a complete success, as proved by this splendid documentary film.

With the enormous amount of planning and cost to mount this type of DX expedition, I feel it will be a long time before any amateurs in VK think about going back down to Heard Island, the home of the White Volcano.

SILENT KEY

Hugh VK6FS (or 6 Flying Saucer as he liked to be called) has since become a Silent Key. Hugh, who was one of the leading figures in organizing the above expedition, and their first contact from Heard Island, will be sadly missed by his many regular on-air contacts worldwide.



BRAZIL

Gerson Rissin PY1APS
PO Box 12178 Copacabana
20000 Rio de Janeiro, RJ
Brazil

THE PLEASURE OF BEING AN AMATEUR

This has been told by Joao Havro PY5AVR, and it shows how an unexpected QSO suddenly opened a new horizon for his life.

It was during the month of April, 1981. Joao did not expect he would have such a great surprise on that day, when on 14.030 MHz he heard a call of Edmund Gorecki SP2WI from Gdynia, Poland. Immediately he remembered his grandfather, Luis Havro, who lived for many years in Gdynia. Luis belonged to the Navy and because of the war came to Brazil, leaving behind his brother, Joseph. Arriving here, he always tried to keep in touch with Joseph, but all in vain.

Joao recalls that his grandfather always used to tell stories about the family and his country. These tales stayed forever in his memory, including details and names of small towns. For this reason, he was very moved to hear Edmund. Joao could not refrain from asking if Edmund knew any family with the last name of Havro.

With the strong brotherhood which exists among amateurs, SP2WI at once offered to inquire if there still existed any remainder of the family in town. He asked for a delay of one week, after which he would make a new contact. On the appraised date and hour, with all skill and practice acquired after many years, Havro turned his equipment on and began to call Edmund Gorecki.

It did not take him a long time to get in touch, and to the joy of Havro and all his relatives, Edmund confirmed that he had found a person named Henrik Havro, a grandson of Joseph and therefore a cousin of Joao.

Until then, Joao did not know he had a relative in Poland, and when the first letter from Poland arrived it was impossible to hold back the tears when he held in his hands the letter of a cousin he never dreamed could exist. In the letter, Henrik invited Joao to visit him. Many letters were exchanged between them. And after many preparations and with the kindness of Pan American where he worked during twenty-five years and who granted him a reduction of 50% in the ticket, Joao got on a plane on September 11th.

He visited Miami Beach, traveling afterwards to New York, Frankfurt, and finally to Varsovy (Warsaw). In Varsovy, capital of Poland, center of the country's cultural life and also an important industry center, he stayed for a few days and then continued his trip by train to beautiful Gdynia. The handsomeness of the harbor town, scenery of most of the stories his grandfather used to tell him, soon charmed Joao. Henrik and his wife Irena spotted Joao at the railway station by using pictures of him. The meeting was full of emotion, and the tears were a sign of the great satisfaction they all felt for the realization of a dream which came true.

When they arrived at home, Adam and Klaudiusz, sons of Henrik and Irena, soon introduced themselves. As Joao did not speak Polish, the communication among them was possible only through Irena and her two nieces, Katarzina and Barbra, who spoke flawless English.

Joao stayed there approximately a month. During this time, he got to know Gdansk, where an important dockyard stands, and Sopot and Oliwa, which for their climate and elegance are important tourist centers. He also had the opportunity to visit several well-planted farms. About the Polish people, he remarked that they are devoutly Catholic, dedicated to work, and helpful. There are no slums and no beggars walking on the streets.

With martial law, the Polish government had the transmitters of all radio amateurs sealed, but now they are operating again. And thanks to ham activity, great things may be carried out. Happenings like this stimulate continuation and the propagation of more wonderful things which cross frontiers and spread throughout the world.

Joao's true story reminded me that I could have this same happiness. My father is a Russian, born in the Ukraine in 1914. He came to Brazil when he was only nine years old, together with two brothers older than him. Our family's name is Rissin, and it is not a common name in Russia. My father says that relatives of his father's brother went to America at the same time he came to Brazil. So, if you want to help me, take a look in the phone book of your city and try to find any Rissin there. During trips to the States I have searched in Miami, New York, Orlando, Las Vegas, Los Angeles, San Francisco, and Honolulu, but all in vain. I found a Rissin Jewelry in New York City, but in spite of the Ukrainian background of the owner, he was unable to establish our relationship. I'll be happy to tell you also my story if I do find my own relatives!

CZECHOSLOVAKIA

Rudolf Karaba (OK3KFO ARC)
Komenskeho 1477/8
955 01 Topolcany
Czechoslovakia

CRC, PO Box 68, 113 27 Praha 1, Czechoslovakia, is giving this award: *The Slovensko Award* is issued by the OK3 DX Club of Radio Amateurs of Slovakia to all licensed amateurs who provide proof of contact with stations working in different districts of Slovakia: OK3, OL8, OL9, and OL0 (districts listed in Fig. 1) after January 1, 1946, as follows:

(1) Stations in countries abutting on Slovakia (SP, UB, HA, OE) need 35 districts;

(2) Stations in other European countries need 20 districts, and

(3) DX stations (also USA), 10 districts.

No band or mode restrictions. Not available for SWLs. Applications with GCR list and a fee or 10 IRCs may be sent to CRC. List of districts is in Fig. 1.

POINTS OF INTERESTS:

OK3CAQ made contacts for WAC when operating SSB on the 3.5-MHz band in the night of May 8–9, 1984. These contacts had been made in the course of 3 hours from the radio club OK3KFY in Stupava with the transceiver Otava (70 Watts input) and the W3DZZ antenna: 2312 UTC—VK6LK, 2334—EA9KF, 0020—EI2L, 0026—AP2ZR, 0058—CP1ES, and 0214—VE2RL.

On July 31, 1984, died one of the pioneers of amateur broadcasting and the best Czechoslovak DX-man, Vladimir Kott OK1FF.

On OSCAR 10, mode B, after a long time, another radio ham appeared. It is Jan OK2EH.

Annually in Czechoslovakia, the shortwave championships have been held in these categories: individuals, radio clubs, OL stations (youth up to 18 years), and listeners. The best station in each category gains the title of the champion of Czechoslovakia. For the championships, the first 20 stations in each category and three best placements of these contacts have been recorded: *CQ* WW DX Contest—CW, *CQ* WW DX Contest—SSB, WAEDC—CW, WAEDC—SSB, IARU Championship, and the OK-DX Contest.

NEW WORLD RECORDS

At the end of May, 1984, a new world record on 24 GHz had been gained by the operators of stations I4CHY and IW3EHQ/I3SDY by their contacts for the distance of 289 kilometers between locators GD44b and GG72j. Both the stations had used transmitters with inputs of 100 milliwatts from Gunn oscillators and receivers with a noise figure of 5.5 dB.

Another world record has been made by the operators of stations DL1CR and DL3ER from Munich, who, in the 47-GHz band, had overcome the distance of 13 kilometers and had used a parabolic antenna with a diameter of 9 centimeters and transmitters with inputs of 0.5 mW.

RTTY

OK1DRX has worked out some programs for CW and RTTY for ZX-Spectrum. The computer is directly working out and generating a low-frequency signal without any further technical equipment necessary.

Banska Bystrica	Poprad
Bardejov	Povazska Bystrica
Bratislava	Presov
Bratislava-vidiek	Prievidza
Cadca	Rimavska Sobota
Dolny Kubin	Roznava
Dunajska Streda	Senica
Galanta	Spisska Nova Ves
Humenne	Stara Lubovna
Komarno	Svidnik
Kosice	Topolcany
Kosice-vidiek	Trebisov
Levice	Trencin
Liptovsky Mikulas	Trnava
Lucenec	Velky Krtis
Martin	Vranov
Michalovce	Zvolen
Nitra	Ziar nad Hronom
Nove Zamky	Zilina

Fig. 1. Districts in OK3 and OK8–9.

INDIA

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Amateur Radio Society of India
PO Box 3005
New Delhi 003
India

NEWS FROM INDIA

Mr. Rajiv Gandhi (age 40 yrs) became the Prime Minister of India in the evening of 31 October, 1984. He passed the 1st Grade amateur examination in 1974 and was allotted callsign VU2RG on 1st January, 1975. Ever since, he remained active generally on 21/28 MHz and added activity on 144–146 MHz in the past two years. His interests during and after school days remained with aviation and electronics. He was a keen home-brewer in electronics, and witnessing amateur radio in action (at the QTH of his uncle), he started taking training in amateur radio in 1974. Just after obtaining callsign VU2RG, within 3 months, he made his first home-brew HF CW/SSB transceiver and a two-element cubical quad antenna. He used this setup till 1980, making a large number of contacts. He printed two different QSL card designs in the course of 5 years and constantly dispatched outward QSL cards via the ARSI QSL Bureau, New Delhi.

After he became a Member of Parliament (Lok Sabha: Lower House) in June, 1981, and till today, he was constantly working for progressive developments in

The Slovensko Award.

aviation and electronics, including amateur radio. It is due to his constant efforts that computer training will percolate in school levels in India hereafter, that several aids have been given to the electronic trade/industry, and that the government of India is now seriously considering easier import rules for computers. In summer vacation, 1984, he trained his 14-year-old son Rahul Gandhi on computers. In amateur activity, he took up the cause of amateurs individually or collectively, organized emergency amateur participation to maintain communications during cyclone and flood disasters in Western India at times when all known channels of civil communications failed, and persuaded the government of India to consider the request of the ARSI to allow custom-duty-free import of amateur equipment, accessories, and components. Such facilities are now available in favor of each amateur in this country till 31 March, 1985.

During 1975, his wife, Mrs. Sonia Gandhi, passed the 1st Grade amateur examination at New Delhi and was allotted call-sign VU2SON, and she too remained active all these days on 21/28 and 144–146 MHz. In 1984, VU2RG and VU2SON induced their son and daughter, Priyanka Gandhi (12 years old), to get trained in amateur radio. Amar VU2CZ, who trained VU2RG/SON earlier in 1974/75 and is training Rahul and Priyanka in 1984, is hopeful that by January, 1985, the two children will be on the air. Amateur radio was/is a quality way of life, and part of it now is in the Prime Minister's residence.

Rajiv Gandhi was very enthusiastic about the New Delhi visit of Noel Eaton VE3CJ, president of the IARU, in March, 1975, and the then-Prime Minister, Mrs. Indira Gandhi, met Mr. and Mrs. Eaton at the QTH of VU2RG. A photograph of the meeting appeared in *QST* later. Like our beloved Indira Gandhi, who served for unification of world, VU2RG's feelings are in the same direction, as is evident from the fact that he displayed the amateur-radio poster titled ONE WORLD—ONE LANGUAGE at the two exhibitions on amateur radio at New Delhi (meant for school children) at the entrance of the exhibitions; many times that poster in miniature size got displayed in his car. (The stock of that poster may be exhausted now.) Similarly, the ITU posters of WCY 1983 were displayed in his office, which used to receive at least 500 visitors every day belonging to all walks of life from all over India.

The amateur station of VU2RG/SON happens to be the foremost in this country, and VU2RG is all the time endeavoring to keep abreast of modern technology and developments in amateur radio. The number of amateur-radio journals read by him surpasses that read in the ARSI. Any new development in amateur-radio technology published in any non-IARU journal is eventually sent by him to the ARSI for reading and return. On October 23, 1984, he spoke to Amar VU2CZ to find out details of accessories required further for Amateur Radio Computer Network (packet radio) to suit his HF transceiver, FT-1, and VHF transceiver, TR-7850, and was equally enthusiastic to incorporate, if feasible, the DCS (Digital Coded Squelch) system in place of CTCSS in his TR-7850 or TR-2500. In July, 1984, he was granted permission to install a "closed repeater" in the amateur VHF service (144–146 MHz) with call-sign VU2RRG. The equipment is awaited from abroad, and when installed will be the first amateur repeater (relay) station in India and the first really sophisticated amateur repeater in Asia. He has not yet turned his eyes towards amateur satellite communications and it is appropriate that we try to introduce his two children to this field. It may not be out of place to mention that apart from being the Prime Minister, he holds the additional portfolio of being the Minister for the Department of Electronics.

For further coordination, all are requested to keep the Amateur Radio Society of India (ARSI) informed about any message or news published in this context or any equipment details that are proposed to be sent to VU2RG. In view of the fact that he has presently very busy schedules and the country's General Election is forthcoming, we are not sure as to how much it will be possible for him to respond to communications from amateurs, but no communication sent to him is likely to remain unnoticed. To us, VU2RG represents the spirit of dedication and achievement.

LIBERIA

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Brothers of the Holy Cross
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Republic of Liberia

AMATEUR RADIO IN LIBERIA

The Mano River flows from the northeast, forming part of the northern border of Liberia. It marks a section of the edge of Sierra Leone to the south and empties into the Atlantic Ocean some forty miles to the southeast. As rivers go, it is not impressive, but during the torrential tropical rains of Liberia it can grow to a formidable size in a short time.

Liberia has at least four sites where iron ore has been found and mined. Two of these sites have been depleted so that the financial returns from the mining operations are marginal. Bong Mines is one of the sites where the deposits are so poor that the ore has to be separated from the rock and pelletized before it can be shipped. Six of the members of the administrative staff are amateurs, and they maintain a two-meter repeater which is accessible from Monrovia.

In the Mano River area there is another mine which is very extensive in the land that it covers. The ore is deposited in scattered pockets so that a lot of road building is required. When one of these pockets is located, the topsoil has to be pushed away so that the ore can be scooped up and hauled to the crusher. After that it is washed and finally they have a product that is sixty-seven-percent ore.

This washing requires vast amounts of water. As nearly as I can ascertain the situation, the National Mining Company built a kind of a natural reservoir on the side of one of the hills just above the Mano River to serve as a water supply for the mining operation. Along the opposite side of the river the terrain was more flat, somewhat fertile, and with the river nearby it seemed an ideal spot to build homes. Gradually a residential community grew up in that area with homes that were quite substantial and permanent.

I have not been able to collect all the historical data, so it is not clear just how many years this little community flourished. It was in my second year in Liberia that the disaster struck. It was at the height of the rainy season and the rains seemed to be extraordinarily persistent and heavy. The whole earth was saturated with water and the whole side of the mountain let go. They called it a mud slide. The whole land mass along with the water from the reservoir slid down the hill, across the river and inundated the homes. It was sudden and without warning.

The amateurs were not there.

It would be nice to write a glowing account of heroic amateur activity but there is none to write. There were two amateurs present at the disaster, but both of them being doctors, they were occupied with things other than amateur communication.

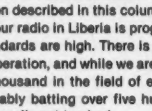
Our faces are red and we feel very badly but we have lots of excuses. Even if we had had the necessary field equipment, it is doubtful that we could have reached the Mano River disaster area. The road out of Monrovia is blacktop, but when it reaches Bomi Hills the pavement terminates and from there on it is laterite, and during the rainy season it becomes very difficult.

This whole story is the result of a recent visit to Mano River and the mining operation. Three of us (amateurs) drove up to give an examination for an amateur license. It was a four-hour trip one way and there were times when we were not sure that we should continue. We did make it, however, and it is another experience which this amateur will not soon forget.

We visited the mine and we visited the site of the disaster. The excavated walls and foundations were a stark reminder of the reality, and the beautiful little cemetery with its monument to preserve the names of the victims lent credence to the story of what had taken place. We have spent much time and effort to formulate a practical plan which can be implemented so that we will be ready should the need arise again; we do not have a plan yet.

The history of amateur service in Liberia does have brighter spots. The Lassa Fever epidemic is one. The amateurs, in that emergency, set up international communication which, in great measure, helped to bring the epidemic under control. On a lesser side, our doctors routinely use amateur radio to advise each other and to advise medics who find themselves confronted with a serious problem up in the bush where there is no doctor available. Both of these amateur activities have been described in this column.

Amateur radio in Liberia is progressing. The standards are high. There is goodwill and cooperation, and while we are not batting a thousand in the field of effort, we are probably batting over five hundred—which is really not too bad.



MEXICO

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Mexico, D.F.

NEWS IN MEXICO

No doubt you heard the news about the horrible explosion and fire in the Mexico City suburb leaving hundreds dead, over 1500 wounded, and thousands homeless. Of course, line communication to that particular area was automatically wiped away, leaving a tremendous task for government agencies—and yes, ham-radio operators on both two meters and HF. The National Emergency Network was busy for days on those bands! We can certainly appreciate the effort of local and national hams as well as aid given by the US when most needed.

CAPABLE VOLUNTEERS IN MEXICO?

A station in Mexico that could serve as a gateway into the North American Teleconference Radio Net (TRN) is needed. The purpose of TRN is to provide high-quality education and informational programs of interest to all amateurs.

Most of the gateway stations in Canada and the US are VHF repeater stations. However, we believe an HF station would be more appropriate to provide wide-area coverage in Mexico. All that would be required at that station is a phone patch and the ability to initiate a call into the teleconference bridge in the US (probably Minneapolis, Minnesota). Or it might be possible to arrange a radio relay from the US, although this approach would probably strain audio quality and make it difficult to provide two-way interaction with Mexican amateurs and the featured speaker on the net.

Please contact me as soon as possible if you think you have a station that could serve as a gateway (tie-in station with two-way capability) in Mexico. Your comments and suggestions regarding the applicability and interest in the TRN in Mexico will also be appreciated. If you have a telephone number at which you may be reached during the day, please send this along as well.

This would be a great opportunity for Mexican amateurs to get in on discussions with full two-way contact with the featured speaker and be able to get many of their questions answered. Of course, participants from Mexico could give their own suggestions and make their interesting comments. It is expected that 75,000 amateurs will be tuned into the net!

Stations are tied together by dialing into a teleconference bridge. Each participant must bear the cost for the long-distance call. It is desirable to defeat the time-out timer on the autopatch during the net to obviate the need for constant kerchunking during the one to two hours that the net may run.

The teleconference bridge that is being used is the Darome model 2020 "Co-Convenor." This is the most sophisticated multi-point teleconference bridge available to the public today. Most participants will use a bridge owned by the Darome Connection in Chicago for the next net. This will give you some idea of the cost for the call into the bridge from your location.

If you are in Mexico, contact me personally. If you are not, then please write to: Richard A. Whiting W0TN, TRN Net Manager, Honeywell Amateur Radio Club, 4749 Diane Drive, Minnetonka MN 55343; his work phone: (612)-870-2071.

We look forward to opening up this opportunity to amateurs here throughout Mexico towards the further advancement of amateur radio!

VENEZUELA

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Venezuela

Circuito 3 (call area 3) is made up of the states of Lara, Yaracuy, and Portuguesa. The capital city of Lara is Barquisimeto, the largest city of the country after Caracas, Maracaibo, and Valencia.

It is said that Barquisimeto was founded in 1552 by Juan de Villegas. However, he named the city Nueva Segovia. In fact, he came to the area not to found a city but to develop the mines of Buria, discovered earlier by a compatriot. The town was destroyed by the slaves when they revolted;

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Controlling and talking through PRIVATE PATCH II is almost always quicker and easier than using a sampling patch. This is because you may talk or send control commands the instant you press the PTT button. The ability to break in or take control is assured by interrupt control logic. The interrupt controller creates a window (similar to sampling) but is seldom heard in normal quick back and forth communication. With a sampling patch you press the MIC button for one to five seconds before talking on each and every transmission. This is very frustrating for the mobile, and causes confusion for each party.

The sampling process reduces the effective range of your base radio. This is because if a sample, and a signal fade coincide, the sampling patch thinks the mobile is not transmitting. This causes a sampling patch to become erratic at ranges still very useable by PRIVATE PATCH II. PRIVATE PATCH II will not diminish the range of your system.

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the Spaniards escaped and founded a new city near the Turbio (turbid) river. They still called the town Nueva Segovia, but since the Indians called the river by their word for turbid, Barquisimeto, that's why the city was finally so called. This happened 10 years after Juan de Villegas died.

Lara state has been almost exclusively an agricultural settlement. Actually, the landscape is arid but the valleys of the Turbio and Tocuyo rivers have produced sugar, potatoes, tomatoes, onions (and goats) since then. Nevertheless, nowadays Barquisimeto is a large industrial area that is growing to the north of the city.

Barquisimeto is very well designed. All calles (streets) run from south to north while carreras (avenues) run east to west. On the even-numbered carreras, traffic flows west and on even-numbered calles, the traffic flows north. However, the numbering is a bit cumbersome. For example, the address, Carrera 18 No. 25-23, means a place on Carrera 18 located some 23 meters from Calle 25 in the block situated between Calle 25 and Calle 26.

The best repeater site in Barquisimeto is Terepaima Mountain, but it is not the only one in the area—there is also Loma Leon, not so high but it has many repeaters installed. At the beginning of this year, several repeaters were stolen from Terepaima. This caused a massive moving to Loma Leon, where the local police have a repeater site. However, I have talked with a friend who has some investment in Terepaima and he assured me that it is safe nowadays.

Yaracuy State

San Felipe, the capital city of Yaracuy, is some four hours from Caracas. It is located midway on the Barquisimeto-Puerto Cabello railroad. It was originally named San Felipe El Fuerte (Saint Phillip The Strong) and founded by Royal decree on November 6, 1729, to be the commercial and administrative center of this region (now Yaracuy State). Venezuela was at that time the world's main producer of chocolate and Spain was the chief consumer. On March 26, 1812, the city was destroyed by the strongest earthquake this country has ever known. The destruction was so complete that the ruins were left undisturbed and a new town was built to the north. Today, San Felipe is a good-looking city with many boulevards and nice suburbs.

Aroa is 77 km north of San Felipe. This place is well known for the gold and copper mines. It is located near the Yurubi National Park, which was created to protect all the mountainous areas which feed the Yaracuy river. The very first copper mines were owned by the family of Libertador Simon Bolivar. In 1977, the National Institute of Parks created the Aroa Mines Park. The old cemetery and some houses were restored, and there is part of the old railroad and smelter. The crushers and the main galleries of the mine itself are 3 km up the gorge. The old bridges look dubious but carry the weight of the school buses that bring students to this area. From the crushers you may walk up to the old colonial Spanish residential camp and to the old English company house that sometime during 1832 administered the mines while Simon Bolivar stayed in London.

Portuguesa State

The capital city of this state is Guanare, a small town founded in 1591 by Captain Juan Fernandez Leon. For years the constant incidence of malaria and cholera deterred the growth of this city. It was only after 1913, when the malaria was eradicated, that this area became a prosperous agricultural center. (Many people think that the capital of this state is Acarigua, a small town with some 6000 inhabitants in 1950 but 100,000 today; it is the largest city of Portuguesa State.) As with the rest of this territory, Acarigua's economy is based on agriculture. The city of Araure is so close to Acarigua that it is almost the same city.

Southwest of Acarigua is located the Rockefeller Palo Gordo Ranch, a place bought in 1955 by Nelson Rockefeller. The 2000-hectare ranch (800-plus acres) is used to operate a technical assistance program, with three divisions of agricultural research in cooperation with the Venezuelan government. The industrial division mills its own and other people's rice, sesame, and corn, and has a storage capacity for some 7 million pounds of rice. The animal division breeds Santa Gertrudis cattle which are sold for breeding stock. (The Santa Gertrudis, bred on the King Ranch in Texas, were the first breed of cattle developed in the western hemisphere specially suited to resist dry seasons or dry grass.) The third division grows rice under irrigation for seed, all of which is sold in Venezuela. The foundation strains for this new variety of rice came from the Ministerio de Agricultura y Cria, the Rockefeller and Ford Foundation rice research in the Philippines which developed the strains of rice that have produced the "green revolution" in the Orient.

As you can appreciate, the largest city in the area is Barquisimeto and hence has the largest number of amateurs, followed by San Felipe. Being mountainous, there are several repeater sites and hams are linked by 2-meter FM. From any place in the area you may get in contact with all the rest of the country except for the plains south of the Orinoco river.

More on Maps

Yes, I like city maps and will continue to exchange maps of Caracas with all fellow hams who send along a map of their cities except, this time, the following, of which I now have too many: Panama City, New York, Los Angeles, Miami, Dade County (FL), Oregon, Livermore, Portland, and Quito (Ecuador). (Also have received some highway maps that I appreciate, but remember that my request is for city maps. Please don't send souvenir or sightseeing maps.) Rand McNally preferred but Dolph's is OK. None received from Europe and Asia. Have none of any city of NH.

Jose CT1BNK operating the CNE-46 JOTA station.

Seminar on Satellites

Sponsored by the Asociacion de Radioaficionados de Venezuela (ARV), a seminar on satellites was held last October 27. I was invited to address it and I did, on the history of radio amateur satellites. More that 100 hams were present at the Universidad Central de Venezuela, where the event took place. There is great interest in this facet of amateur radio and I feel that a new seminar should be organized, although I suggested that this kind of event be prepared separately for beginners and experienced amateurs. Each time an experienced amateur asked a question during the seminar, the beginner went into a daze. Certainly the people without experience in space communications get lost, too, during too technical discussions, and interest drops. So far I have gathered some material on satellites, and I'll be pleased to organize, with others' help, a new event of this kind. In the meantime, the next ARV seminar was to be on HF antennas, in January.

The assistance of Edgar YV5ZZ was invaluable during the seminar. He is very active on OSCAR 10 and also a recognized moonbouncer. It is a delight for any aficionado to make a visit to Edgar's home. He has a big stack of 16 yagis for 432 MHz in his garden and another stack for 144 plus HF on the roof. The radio shack is a cornucopia of communications equipment and computers. He has the WAC award on 432-MHz EME with 55 contacts, the very first in Latin America on 70 cm. Now he is planning a 3-meter parabolic to go higher in frequency.

PORTUGAL

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Portugal

On the 20th and 21st of October of 1984, the XXVII Annual Jamboree On The Air (JOTA) took place around the world and, among other things, it created a good opportunity to exchange messages and establish communications among several Scout Associations.

For many years Portugal has been one of the leading countries in this annual event, thanks to the good receptivity and understanding of the Portuguese and foreign hams living here, as well as the local authorities.

A few weeks before the event, we saw great acitvity in choosing the best spots for antennas, ham rigs, etc. So Senior Aspirants, Wayfarers, Head Masters, and also some Explorers didn't waste time. After some hard work fixing a couple of clamps into the wall of an old house serving as a Scout Headquarters for CNE-46 (CNE stands for *Corpo Nacional de Escutas*), we finally had found a nice place for a dipole-duobander 2BDQ for 40 and 80 meters.

A self-supporting tower was made, and on the top of that we had a mini-quad HQ1 for 10, 15, and 20. Jose Reis CT1BNK loaned his rig, a Kenwood TS-520SE, for HF and an FT-221R for VHF. He was active for about 48 hours, that is, Saturday and Sunday. The antennas had been mounted on Friday night, and they just finished at 23:30 GMT.

At 0000 we heard a few hundred stations on 80, and for the first time since its foundation, CNE-64 in Cacem had the first JOTA from its own headquarters.

It may be of interest to you that some of the boys did not realize the simplicity of saying hello to New York City, Johannesburg, Brasilia, or Mexico City, using that skeleton on the top of the tower and a small rig such as the one that we had. I won't comment on some of their expressions (HI)!

After a brief speech about the hobby and the reason for our presence there, CT1BNK didn't leave his TS-520SE, so a good score was made on 80 and 40. Things on higher bands were not very good, but they worked some Brazilian stations on 20 at dawn. At daylight, signals from all over Europe were very strong and loud on 20, 15, and 10 meters, too. France, England, Malta, Italy, Spain, the Canary Islands, the Azores, and Madeira were the best signals in our log book. However, we worked a couple of stations in South Africa, South America, the USA, and Canada. In their messages, the Scouts usually exchanged their addresses for future correspondence, new ideas.

As a result of this operation, next year we should hear some of the boys using their own callsigns since a few showed interest in preparing the papers for their first ticket. This promises another good or an even better operation for the coming year. As a matter of fact, five members were elected to form a ham-radio department (and, of course, I will give them all the support I can).

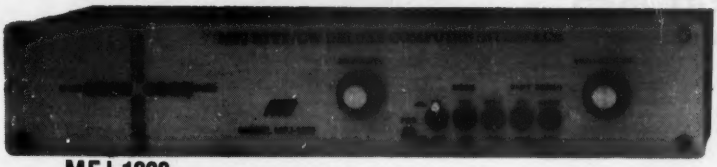
Every year we do work for the CNE-75 (Estoril Headquarters) located in the heart of this well-known village. Pinto CT4DZ, Jose CT1BNK, and Mike CT4UE are the hams who usually work with that group. On the XXVI Jamboree (1983) they had the special callsign, CT5EST. This year, however, due to the late opening of the activities in CNE-75, they were out of business, but next time they will be well represented, too.

Interest in this nice hobby is not as big as it should be due to a couple of barriers we all face at the beginning. Believe it or not, an SSB transceiver costs over US$1,700, which is too much! Don't believe it? What about a TH6DXX at US$590, a Commodore 64 at US$700, and a handheld 2m transceiver at US$392? The wine is cheap, but these crazy things (as my girl friend says) are absolutely untouchable.

That's all, folks; 73 from Estoril.

NEW FROM MFJ

MFJ'S MOST ADVANCED RTTY/ASCII/AMTOR/CW COMPUTER INTERFACE HAS FM, AM MODES, LED "SCOPE" TUNING ARRAY, RS-232 INTERFACE, VARIABLE SHIFT TUNING, 170/850 Hz TRANSMIT, TRUE MARK-SPACE DETECTION.



MFJ-1229
$179.95

FREE MFJ RTTY/ASCII/CW software for C-64/VIC-20. Complete package includes MFJ-1229, software on tape, cables for C-64/VIC-20.

Engineering, performance, value and features sets MFJ's most advanced RTTY/ASCII/AMTOR/CW computer interface apart from others.

FM (limiting) mode gives easy, trouble-free operation. Best for general use, off-shift copy, drifting signals, and moderate signal and QRM levels.

AM (non-limiting) mode gives superior performance under weak signal conditions or when there are strong nearby stations.

Crosshair mark-space LED tuning array simulates scope ellipse for easy, accurate tuning even under poor signal-to-noise conditions. Mark and space outputs for true scope tuning.

Transmits on both 170 Hz and 850 Hz shift.

Built-in RS-232 interface, no extra cost.

Variable shift tuning lets you copy any shift between 100 and 1000 Hz and any speed (5-100 WPM RTTY/CW and up to 300 baud ASCII). Push button for 170 Hz shift.

Sharp multi-pole mark and space filters give true mark-space detection. Ganged pots give space passband tuning with constant bandwidth. Factory adjusted trim pots for optimum filter performance.

Multi-pole active filters are used for pre-limiter, mark, space and post detection filtering. Has automatic threshold correction. This advanced design gives good copy under QRM, weak signals and selective fading.

Has front panel sensitivity control.

Normal/Reverse switch eliminates retuning while checking for inverted RTTY. Speaker jack. +250 VDC loop output.

Exar 2206 sine wave generator gives phase continuous AFSK tones. Standard 2125 Hz mark and 2295/2975 Hz space. Microphone lines: AFSK out, AFSK ground, PTT out and PTT ground.

FSK keying for transceivers with FSK input.

Has sharp 800 Hz CW filter, plus and minus CW keying and external CW key jack.

Kantronics software compatible socket.

Exclusive TTL/RS-232 general purpose socket allows interfacing to nearly any personal computer with most appropriate software. Available TTL/RS-232 lines: RTTY demod out, CW demod out (TTL only), CW-ID in, RTTY in, PTT in, key in. All signal lines are buffered and can be inverted using an internal DIP switch.

Metal cabinet. Brushed aluminum front. 12½x2½x6 inches. 18 VDC or 110 VAC with optional AC adapter, MFJ-1312, $9.95.

Plugs between rig and C-64, VIC-20, Apple, TRS-80C, Atari, TI-99 and other personal computers. Use MFJ, Kantronics, AEA and other RTTY/ASCII/AMTOR/CW software.

7-IN-1 RTTY OPERATING AID

MFJ-1221
$79.95

Indispensable. Improves any RTTY station.

1. **Crosshair LED "scope" Tuning Array.** Makes tuning quick and easy with dead-on accuracy. Tune for maximum vertical and horizontal display.
2. **Scope Adapter.** Mark/Space outputs for scope.
3. **Shift Indicator.** LEDs indicate 170, 425, 850 Hz shift. Especially useful for RTTY outside ham bands.
4. **Sharp Mark and Space Filters.** Greatly improves copy under crowded, fading and weak signal conditions. For 170, 425, 850 Hz shifts.
5. **Normal-Reverse Switch.** Check for inverted RTTY without changing sidebands and retuning.
6. **Output Level Control.** Adjust signal level into TU.
7. **Limiter.** Evens out signal variation for easier, smoother copy.

Plugs between receiver and TU. Mark is 2125 Hz and Space is 2295, 2550, or 2975 Hz. 10x2x6 inches. Uses floating 18 VDC or 110 VAC with AC adapter, MFJ-1312, $9.95.

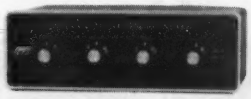
24/12 HOUR CLOCK/ID TIMER

MFJ-106 **$19.95**

Switch to 24 hour UTC or 12 hour format! Battery backup. ID timer alerts every 9 minutes after reset. Red .6 in. LEDs. Synchronizable to WWV. Alarm, Snooze function. Minute, hour set switches. PM, alarm on indicators. Gray/Black cabinet. 5x2x3 in. 110 VAC, 60 Hz.

MFJ ELECTRONIC KEYER

MFJ-407
$69.95



MFJ-407 Deluxe Electronic Keyer sends iambic, automatic, semi-auto or manual. Use squeeze, single lever or straight key. Plus/minus keying. 8 to 50 WPM. Speed, weight, tone, volume controls. On/Off, Tune, Semi-auto switches. Speaker. RF proof. 7x2x6 inches. Uses 9 V battery, 6-9 VDC or 110 VAC with AC adapter, MFJ-1305, $9.95.

MFJ PORTABLE ANTENNA

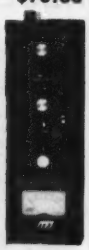
MFJ's Portable Antenna lets you operate 40, 30, 20, 15, 10 meters from apartments, motels, camp sites, vacation spots, nearly any electrically clear location where space for a full size antenna is a problem.

A telescoping whip (extends to 54 in.) is mounted on self-standing 6x3x6 inch aluminum case. Built-in antenna tuner, field strenght meter, 50 feet RG-58 coax. Complete multi-band-portable antenna system that you can use nearly anywhere. Up to 300 watts PEP.

MFJ-1621
$79.95

MFJ ANTENNA BRIDGE

MFJ-204
$79.95



MFJ Antenna Bridge. Trim your antenna for optimum performance quickly and easily. Read antenna resistance up to 500 ohms. Covers all hams bands below 30 MHz. Measure resonant frequency of antenna. Tells to lenghten or shorten antenna. Easy to use, connect antenna, set frequency, adjust bridge for meter null and read antenna resistance. Has frequency counter jack. Use as signal generator. Portable, self contained. 4x2x2 in. 9 V battery or 110 VAC with adapter, MFJ-1312, $9.95.

MICROPHONE EQUALIZER

MFJ-550
$49.95

Greatly improves transmitted SSB speech for maximum talk power. Evens out speech peaks and valleys due to voice, microphone and room characteristics that makes speech hard to understand. Produces cleaner, more intelligible speech on receiving end. Greatly improves mobile operation by reducing bassy peaks due to acoustic resonances. Plugs between mic and rig. 4 pin mic jack, shielded output cable. High, mid, low controls provide ±12 db boost or cut at 490, 1170, 2800 Hz. Mic gain, on/off/bypass switch. "On" LED. 7x2x6 inches. 9 V battery, 12 VDC or 110 VAC with adapter, MFJ-1312, $9.95.

ORDER ANY PRODUCT FROM MFJ AND TRY IT-NO OBLIGATION. IF NOT DELIGHTED, RETURN WITHIN 30 DAYS FOR PROMPT REFUND (LESS SHIPPING).
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THE MOST AFFORDABLE REPEATER

ALSO HAS THE MOST IMPRESSIVE PERFORMANCE FEATURES

(AND GIVES THEM TO YOU AS STANDARD EQUIPMENT!)

JUST LOOK AT THESE PRICES!

Band	Kit	Wired/Tested
10M,6M,2M,220	$680	$880
440	$780	$980

Both kit and wired units are complete with all parts, modules, hardware, and crystals.

CALL OR WRITE FOR COMPLETE DETAILS.

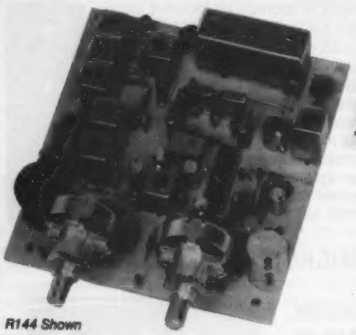
Also available for remote site linking, crossband, and remote base.

FEATURES:

- SENSITIVITY SECOND TO NONE; TYPICALLY 0.15 uV ON VHF, 0.3 uV ON UHF.
- SELECTIVITY THAT CAN'T BE BEAT! BOTH 8 POLE CRYSTAL FILTER & CERAMIC FILTER FOR GREATER THAN 100 dB AT ± 12KHZ. HELICAL RESONATOR FRONT ENDS. SEE R144, R220, AND R451 SPECS IN RECEIVER AD BELOW.
- OTHER GREAT RECEIVER FEATURES: FLUTTER-PROOF SQUELCH, AFC TO COMPENSATE FOR OFF-FREQ TRANSMITTERS, SEPARATE LOCAL SPEAKER AMPLIFIER & CONTROL.
- CLEAN, EASY TUNE TRANSMITTER; UP TO 20 WATTS OUT (UP TO 50W WITH OPTIONAL PA).

HIGH QUALITY MODULES FOR REPEATERS, LINKS, TELEMETRY, ETC.

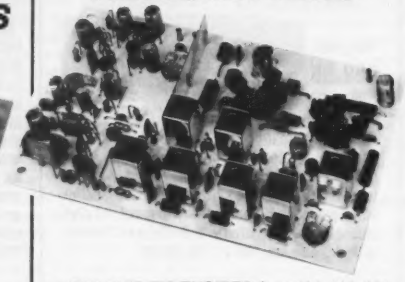
HIGH-PERFORMANCE RECEIVER MODULES



R144 Shown

- **R144/R220 FM RCVRS** for 2M or 220 MHz. 0.15uV sens.; 8 pole xtal filter & ceramic filter in i-f, helical resonator front end for exceptional selectivity, more than −100 dB at ±12 kHz, best available today. Flutter-proof squelch. AFC tracks drifting xmtrs. Xtal oven avail. Kit only $138.
- **R451 FM RCVR** Same but for uhf. Tuned line front end, 0.3 uV sens. Kit only $138.
- **R76 FM RCVR** for 10M, 6M, 2M, 220, or commercial bands. As above, but w/o AFC or hel. res. Kits only $118. Also avail w/4 pole filter, only $98/kit.
- **R110 VHF AM RECEIVER** kit for VHF aircraft band or ham bands. Only $98.
- **R110-259 SPACE SHUTTLE RECEIVER,** kit only $98.

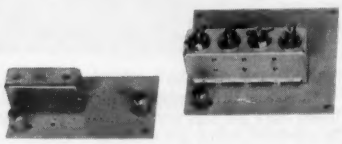
TRANSMITTERS



- **T51 VHF FM EXCITER** for 10M, 6M, 2M, 220 MHz or adjacent bands. 2 Watts continuous, up to 2½ W intermittent. $68/kit.

- **T451 UHF FM EXCITER** 2 to 3 Watts on 450 ham band or adjacent freq. Kit only $78.
- **VHF & UHF LINEAR AMPLIFIERS.** Use on either FM or SSB. Power levels from 10 to 45 Watts to go with exciters & xmtg converters. Several models. Kits from $78.
- **A16 RF TIGHT BOX** Deep drawn alum. case with tight cover and no seams. 7 x 8 x 2 inches. Designed especially for repeaters. $20.

ACCESSORIES



- **HELICAL RESONATOR FILTERS** available separately on pcb w/connectors.

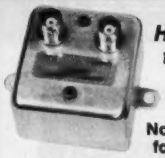
  HRF-144 for 143-150 MHz $38
  HRF-220 for 213-233 MHz $38
  HRF-432 for 420-450 MHz $48

- **COR-2 KIT** With audio mixer, local speaker amplifier, tail & time-out timers. Only $38.
- **COR-3 KIT** as above, but with "courtesy beep". Only $58.
- **CWID KITS** 158 bits, field programmable, clean audio, rugged TTL logic. Kit only $68.
- **DTMF DECODER/CONTROLLER KITS.** Control 2 separate on/off functions with touchtones®, e.g., repeater and autopatch. Use with main or aux. receiver or with Autopatch. Only $90
- **AUTOPATCH KITS.** Provide repeater autopatch, reverse patch, phone line remote control of repeater, secondary control via repeater receiver. Many other features. Only $90. Requires DTMF Module.

- **NEW – SIMPLEX AUTOPATCH** Use with any transceiver. System includes DTMF & Autopatch modules above and new Timing module to provide simplex autopatch and reverse autopatch. Complete patch system only $200/kit. Call or write for details.

hamtronics®

NEW LOW-NOISE PREAMPS RECEIVING CONVERTERS TRANSMIT CONVERTERS



Hamtronics Breaks the Price Barrier!

*

No Need to Pay $80 to $125 for a GaAs FET Preamp.

FEATURES:

- Very Low Noise: 0.7 dB VHF, 0.8 dB UHF
- High Gain: 18 to 28 dB, Depending on Freq.
- Wide Dynamic Range for Overload Resistance
- Latest Dual-gate GaAs FET, Stable Over Wide Range of Conditions
- Rugged, Diode-protected Transistors
- Easy to Tune
- Operates on Standard 12 to 14 Vdc Supply
- Can be Tower Mounted

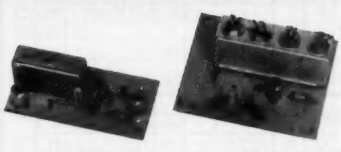
MODEL	TUNES RANGE	PRICE
LNG-28	26-30 MHz	$49
LNG-50	46-56 MHz	$49
LNG-144	137-150 MHz	$49
LNG-220	210-230 MHz	$49
LNG-432	400-470 MHz	$49
LNG-40	30-46 MHz	$64
LNG-160	150-172 MHz	$64

ECONOMY PREAMPS

Our traditional preamps, proven in years of service. Over 20,000 in use throughout the world. Tuneable over narrow range. Specify exact freq. band needed. Gain 16-20 dB. NF = 2 dB or less. VHF units available 27 to 300 MHz. UHF units available 300 to 650 MHz.

- P30K, VHF Kit less case $18
- P30W, VHF Wired/Tested $33
- P432K, UHF Kit less case $21
- P432W, UHF Wired/Tested $36

HELICAL RESONATOR PREAMPS



Our lab has developed a new line of low-noise receiver preamps with helical resonator filters built in. The combination of a low noise amplifier and the sharp selectivity of a 3 or 4 section helical resonator provides increased sensitivity while reducing intermod and cross-band interference in critical applications. See selectivity curves at right. Gain = approx.12 dB.

Model	Tuning Range	Price
HRA-144	143-150 MHz	$49
HRA-220	213-233 MHz	$49
HRA-432	420-450 MHz	$59
HRA-( )	150-174MHz	$69
HRA-( )	450-470 MHz	$79

Models to cover every practical rf & if range to listen to SSB, FM, ATV, etc. NF = 2 dB or less.

	Antenna Input Range	Receiver Output
VHF MODELS	28-32	144-148
	50-52	28-30
Kit with Case $49	50-54	144-148
Less Case $39	144-146	28-30
Wired $69	145-147	28-30
	144-144.4	27-27.4
	146-148	28-30
	144-148	50-54
	220-222	28-30
	220-224	144-148
	222-226	144-148
	220-224	50-54
	222-224	28-30
UHF MODELS	432-434	28-30
	435-437	28-30
Kit with Case $59	432-436	144-148
Less Case $49	432-436	50-54
Wired $75	439.25	61.25

SCANNER CONVERTERS Copy 72-76, 135-144, 240-270, 400-420, or 806-894 MHz bands on any scanner. Wired/tested Only $88.

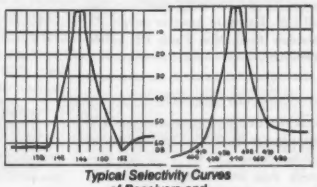
For SSB, CW, ATV, FM, etc. Why pay big bucks for a multi mode rig for each band? Can be linked with receive converters for transceive. 2 Watts output vhf, 1 Watt uhf.

	Exciter Input Range	Antenna Output
For VHF,	28-30	144-146
Model XV2	28-29	145-146
Kit $79	28-30	50-52
Wired $149	27-27.4	144-144.4
(Specify band)	28-30	220-222*
	50-54	220-224
	144-148	50-52
	50-54	144-148
	144-146	28-30
For UHF,	28-30	432-434
Model XV4	28-30	435-437
Kit $99	50-54	432-436
Wired $169	61.25	439.25
	144-148	432-436*

*Add $20 for 2M input

VHF & UHF LINEAR AMPLIFIERS. Use with above. Power levels from 10 to 45 Watts. Several models, kits from $78.

LOOK AT THESE ATTRACTIVE CURVES!



Typical Selectivity Curves of Receivers and Helical Resonators.

SAVE A BUNDLE ON VHF FM TRANSCEIVERS!

FM-5 PC Board Kit – **ONLY $178** complete with controls, heatsink, etc. 10 Watts, 5 Channels, for 2M or 220 MHz.

Cabinet Kit, complete with speaker, knobs, connectors, hardware. Only $60.

REPEAT OF A SELLOUT!

While supply lasts, get $60 cabinet kit free when you buy an FM-5 Transceiver kit. Where else can you get a complete transceiver for only $178

IMPORTANT REASONS WHY YOU SHOULD BUY FROM THE VALUE LEADER:

1. *Largest selection of vhf and uhf kits in the world.*
2. *Exceptional quality and low prices due to large volume.*
3. *Fast delivery; most kits shipped same day.*
4. *Complete, professional instruction manuals.*
5. *Prompt factory service available and free phone consultation.*
6. *In business 21 years.*
7. *Sell more repeater modules than all other mfrs. and have for years. Can give quality features for much lower cost.*

- **Call or Write for FREE CATALOG**
- (Send $1.00 or 4 IRC's for overseas mailing)
- Order by phone or mail ● Add $3 S & H per order
(Electronic answering service evenings & weekends)
Use VISA, MASTERCARD, Check, or UPS COD.

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Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the May '85 issue must be in our hands by March 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15						20	20A	15			
ARGENTINA	20										15	15
AUSTRALIA	20					40	40			20	20	15
CANAL ZONE	40	40					20	15	15	15	15	20
ENGLAND	40	40	40	80	80		20	15	15	15	20	
HAWAII	20					40	20	20			15	15
INDIA							20	20				
JAPAN	15						20	20				15
MEXICO	40	40	40	40	40	40	20	15	15	15	15	20
PHILIPPINES							20	20				
PUERTO RICO	40	40	40	40	40	40	20	15	15	15	15	20
SOUTH AFRICA	40A	40						15	15	20		
U. S. S. R.		40						15	15	20		
WEST COAST	15	20	40	40	40	40	40A	20A	15	15	15	15

CENTRAL UNITED STATES TO:

ALASKA	20				40	40	20	20				20
ARGENTINA	20	40	40	40						15	15	20A
AUSTRALIA	15					40	20	20	20		15	15
CANAL ZONE	20		40	40	40			20	15	15	15	15
ENGLAND	40	40	80	80				15	15	15	20	
HAWAII	20	20			40	40	20	20	20	15	15A	15A
INDIA								20				
JAPAN	20				40	40	20	20				20
MEXICO	20		40	40	40			20	15	15	15	15
PHILIPPINES	20							20	20			
PUERTO RICO	20		40	40	40			20	15	15	15	15
SOUTH AFRICA	20	40	40						15	15	15	20
U. S. S. R.		40	40					15	15	20		

WESTERN UNITED STATES TO:

ALASKA	15	15	20			40	40	40				20
ARGENTINA	20	20		40	40						15	15
AUSTRALIA	15	15	20				40		20	20	20	15
CANAL ZONE	20	20		40	40	40	40	40	15	15	15	15
ENGLAND			40	40					20A	20A		
HAWAII	15	20	20			40	40	40				15
INDIA		20	20									
JAPAN	15	15	20				40	40	40			20
MEXICO	20	20		40	40	40	40	40				15
PHILIPPINES	20A	20								20		
PUERTO RICO	20	20		40	40	40	40	40				15
SOUTH AFRICA	20	20							15	15	15	20
U. S. S. R.								20	20	20	20	
EAST COAST	15	20	40	40	40	40	20	20A	15	15	15	15

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

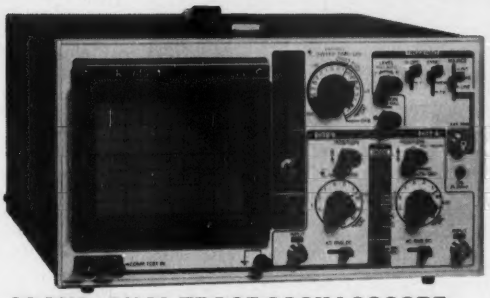
G = Good, F = Fair, P = Poor.

FEBRUARY

SUN	MON	TUE	WED	THU	FRI	SAT
					1 G	2 G
3 G-F	4 F	5 F	6 G	7 G-F	8 F	9 P
10 P-F	11 P	12 F	13 G	14 G	15 F	16 P
17 P	18 G	19 G	20 G	21 G	22 F	23 F-G
24 F-P	25 P	26 P-F	27 G	28 G		

RAMSEY

THE FIRST NAME IN ELECTRONIC TEST GEAR

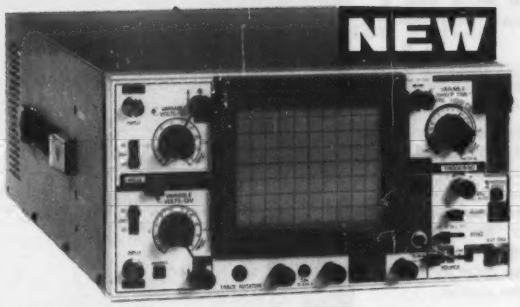


20 MHz DUAL TRACE OSCILLOSCOPE

Unsurpassed quality at an unbeatable price, the Ramsey oscilloscope compares to others costing hundreds more. Features include a component testing circuit for resistor, capacitor, digital circuit and diode testing. • TV video sync filter • wide bandwidth & high sensitivity • internal graticule • front panel trace rotator • Z axis • high sensitivity x-y mode • regulated power supply • built-in calibrator • rock solid triggering

$399.95* high quality hook on probes included

* USA—Add $10.00 per unit for postage, overseas orders add 15% of total order for Insured Surface Mail

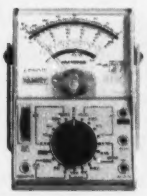


45 MHz DUAL SWEEP OSCILLOSCOPE

The Ramsey 625 is a dual time base, delayed sweep unit that includes a built-in signal delay line to permit clear viewing during very short rise times of high frequency waveforms. Other features include; variable trigger holdoff • 20 calibrated sweep time ranges from 0.5 s/div to 0.2 µS/div. • fully adjustable sweep time • X5 sweep magnification • five trigger sources; CH1, CH2, LINE EXTernal and INTernal (V mode) • front panel x-y operation, Z axis input • sum dif/terence of CH1, and CH2 waveforms displayed as single trace • sweep gate and sweep output • auto focus • single sweep

$799.95* high quality hook on probes included

* USA—Add $10.00 per unit for postage, overseas orders add 15% of total order for Insured Surface Mail.



RAMSEY D-1100 VOM MULTITESTER

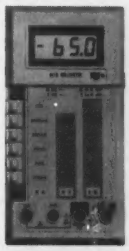
Compact and reliable, designed to service a wide variety of equipment. Features include • mirror back scale • double-jeweled precision moving coil • double overload protection • an ideal low cost unit for the beginner or as a spare back-up unit.

$19.95 test leads and battery included

NEW RAMSEY 1200 VOM MULTITESTER

Check transistors, diodes and LEDs with this professional quality meter. Other features include; decibel scale • 20K volt metering system • 3½" mirrored scale • polarity switch • 20 measuring ranges • safety probes • high impact plastic case

$24.95 test leads and battery included



RAMSEY D-3100 DICITAL MULTIMETER

Reliable, accurate digital measurements at an amazingly low cost • in-line color coded push buttons, speeds range selection • abs plastic tilt stand • recessed input jacks • overload protection on all ranges • 3½ digit LCD display with auto zero, auto polarity & low BAT. indicator

$49.95 test leads and battery included

CT-70 7 DIGIT 525 MHz COUNTER

Lab quality at a breakthrough price. Features • 3 frequency ranges each with pre amp • dual selectable gate times • gate activity indicator • 50mV @ 150 MHz typical sensitivity • wide frequency range • 1 ppm accuracy

$119.95 wired includes AC adapter

CT-70 kit $99.95
BP-4 nicad pack 8.95

CT-90 9 DIGIT 600 MHz COUNTER

The most versatile for less than $300. Features 3 selectable gate times • 9 digits • gate indicator • display hold • 25mV @ 150 MHz typical sensitivity • 10 MHz timebase for WWV calibration • 1 ppm accuracy

$149.95 wired includes AC adapter

CT-90 kit $129.95
OV-1 0.1 PPM oven timebase 58.95
BP-4 nicad pack 8.95

CT-125 9 DIGIT 1.2 GHz COUNTER

A 9 digit counter that will outperform units costing hundreds more. • gate indicator • 24mV @ 150 MHz typical sensitivity • 9 digit display • 1 ppm accuracy • display hold • dual inputs with preamps

$169.95 wired includes AC adapter

BP-4 nicad pack 8.95

CT-50 8 DIGIT 600 MHz COUNTER

A versatile lab bench counter with optional receive frequency adapter, which turns the CT-50 into a digital readout for most any receiver • 25 mV @ 150 MHz typical sensitivity • 8 digit display • 1 ppm accuracy

$169.95 wired

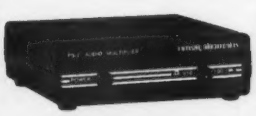
CT-50 kit $139.95
RA-1 receiver adapter kit 14.95

DM-700 DIGITAL MULTIMETER

Professional quality at a hobbyist price. Features include 26 different ranges and 5 functions • 3½ digit, ½ inch LED display • automatic decimal placement • automatic polarity

$119.95 wired includes AC adapter

DM-700 kit $99.95
MP-1 probe set 4.95



PS-2 AUDIO MULTIPLIER

The PS-2 is handy for high resolution audio resolution measurements, multiplies UP in frequency • great for PL tone measurements • multiplies by 10 or 100 • 0.01 Hz resolution & built-in signal preamp/conditioner

$49.95 wired

PS-2 kit $39.95

PR-2 COUNTER PREAMP

The PR-2 is ideal for measuring weak signals from 10 to 1,000 MHz • flat 25 db gain • BNC connectors • great for shifting RF • ideal receiver/TV preamp

$44.95 wired includes AC adapter

PR-2 kit $34.95

PS-1B 600 MHz PRESCALER

Extends the range of your present counter to 600 MHz • 2 stage preamp • divide by 10 circuitry • sensitivity: 25mV @ 150 MHz • BNC connectors • drives any counter

$59.95 wired includes AC adapter

PS-1B kit $49.95

ACCESSORIES FOR RAMSEY COUNTERS

Telescopic whip antenna—BNC plug	$ 8.95
High impedance probe, light loading	16.95
Low pass probe, audio use	16.95
Direct probe, general purpose use	13.95
Tilt bail, for CT-70, 90, 125	3.95

VISA MasterCard

PHONE ORDERS CALL

716-586-3950

TELEX 466735 RAMSEY CI

TERMS: • satisfaction guaranteed • examine for 10 days, if not pleased, return in original form for refund • add 6% for shipping and insurance to a maximum of $10.00 • overseas add 15% for surface mail • COD add $2.50 (COD in USA only) • orders under $15.00 add $1.50 • NY residents add 7% sales tax • 90 day parts warranty on all kits • 1 year parts & labor warranty on all wired units.

RAMSEY

RAMSEY ELECTRONICS, INC.
2575 Baird Rd.
Penfield, N.Y. 14626

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See List of Advertisers on page 80

With SMART PATCH You are in CONTROL

With CES 510SA Simplex Autopatch, there's no waiting for VOX circuits to drop. Simply key your transmitter to take control.

SMART PATCH is all you need to turn your base station into a personal autopatch. SMART PATCH uses the only operating system that gives the mobile complete control. Full break-in capability allows the mobile user to actually interrupt the telephone party. SMART PATCH does not interfere with the normal use of your base station. SMART PATCH works well with any FM transceiver and provides switch selectable tone or rotary dialing, toll restrict, programmable control codes, CW ID and much more.

To Take CONTROL with Smart Patch – Call 800-327-9956 Ext. 101 today.

What To Look For In A Phone Patch

The best way to decide what patch is right for you is to first decide what a patch should do. A patch should:

- Give complete control to the mobile, allowing full break in operation.
- Not interfere with the normal operation of your base station. It should not require you to connect and disconnect cables (or flip switches!) every time you wish to use your radio as a normal base station.
- Not depend on volume or squelch settings of your radio. It should work the same regardless of what you do with these controls.
- You should be able to hear your base station speaker with the patch installed. Remember, you have a base station because there are mobiles. ONE OF THEM MIGHT NEED HELP.
- The patch should have standard features at no extra cost. These should include programmable toll restrict (dip switches), tone or rotary dialing, programmable patch and activity timers, and front panel indicators of channel and patch status.

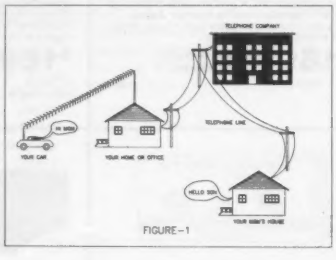
ONLY SMART PATCH HAS ALL OF THE ABOVE.

Now Mobile Operators Can Enjoy An Affordable Personal Phone Patch. . .

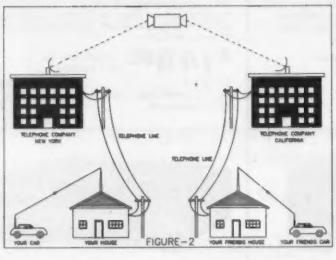
- Without an expensive repeater.
- Using any FM tranceiver as a base station.
- The secret is a SIMPLEX autopatch, The *SMART PATCH*.

SMART PATCH Is Easy To Install

To install *SMART PATCH*, connect the multicolored computer style ribbon cable to mic audio, receiver discriminator, PTT, and power. A modular phone cord is provided for connection to your phone system. Sound simple? . . . IT IS!



FIGURE–1



FIGURE–2

How To Use *SMART PATCH*

Placing a call is simple. Send your access code from your mobile (example: *73). This brings up the Patch and you will hear dial tone transmitted from your base station. Since *SMART PATCH* is checking about once per second to see if you want to dial, all you have to do is key your transmitter, then dial the phone number. You will now hear the phone ring and someone answer. Since the enhanced control system of *SMART PATCH* is constantly checking to see if you wish to talk, you need to simply key your transmitter and then talk. That's right, you simply key your transmitter to interrupt the phone line. The base station automatically stops transmitting after you key your mic. *SMART PATCH* does not require any special tone equipment to control your base station. It samples very high frequency noise present at your receivers discriminator to determine if a mobile is present. No words or syllables are ever lost.

SMART PATCH Is All You Need To Automatically Patch Your Base Station To Your Phone Line.

Use *SMART PATCH* for:

- Mobile (or remote base) to phone line via Simplex base. (see fig 1.)
- Mobile to Mobile via interconnected base stations for extended range. (see fig. 2.)
- Telephone line to mobile (or remote base).
- *SMART PATCH* uses SIMPLEX BASE STATION EQUIPMENT. Use your ordinary base station. *SMART PATCH* does this without interfering with the normal use of your radio.

WARRANTY?
YES, 180 days of warranty protection. You simply can't go wrong.
An FCC type accepted coupler is available for *SMART PATCH*.

CES® ✓462

Communications Electronics Specialties, Inc.
P.O. Box 2930, Winter Park, Florida 32790
Telephone: (305) 645-0474 **Or call toll-free (800)327-9956**

FT-209RH
-RPT SIMP +RPT PMS PMS
1 2 3
SAV T T SQ T SET TX M MSS
4 5 6 M MR
SAVE ENC BEEP MC SHIFT
7 8 9 C
S OFF T OFF B OFF STEP
* 0 # D
S/PO BC CLEAR MAN BUSY KEY LOCK
YAESU

FT-209RH shown actual size.

FT-203R transceiver

The Yaesu FT-209RH. 5 watts that your batteries can live with.

Have the power you need when you need it with Yaesu's new 5-watt, 2-meter handheld. Power to get out in situations where ordinary HTs just won't make it.

We designed our HT with a unique user-programmable Power Saver that puts the rig to "sleep" while you're monitoring and "wakes it up" when the squelch breaks. So you can listen for hours and still have plenty of power to hit those hard-to-reach repeaters when you need to.

With the FT-209RH there's no need to fiddle with knobs when you change from one memory channel to another. That's because you can independently store everything you need in each of the ten memories: receive frequency, standard or non-standard offset, even tone encode/decode with an optional module. And then recall any channel at the touch of a button.

It's easy to hear what's happening on your favorite repeaters or simplex frequencies. Just touch a button and scan all memory channels, or selected ones. Or all frequencies between any two adjacent memories. Use the priority feature to return automatically to your special frequency when it becomes active.

Bring up controlled-access machines with the optional plug-in subaudible tone encoder/decoder, independently programmed from the keyboard for each channel. Listen for tone-encoded signals on selected channels—without having to hear a bunch of chatter—by enabling the decode function.

The FT-209RH, which covers 10 MHz for CAP and MARS use, comes complete with a 500-mAh battery, charger and soft case.

For those who want a basic radio without the bells and whistles, consider the compact, lightweight FT-203R. This economical HT features 2.5 watts of power and an optional DTMF keypad. Most all the accessories for the 209 work with the 203, including an optional VOX headset that gives you hands-free operation that's perfect for public service events.

So when you visit your dealer, let him know you won't settle for anything but the best. A radio built by Yaesu.

YAESU 83

Yaesu Electronics Corporation
6851 Walthall Way, Paramount, CA 90723
(213) 633-4007.

Yaesu Cincinnati Service Center
9070 Gold Park Drive, Hamilton, OH 45011
(513) 874-3100.

Prices and specifications subject to change without notice.

KENWOOD

pacesetter in amateur radio

Digital Code Squelch...
TR-2600A

Kenwood's TR-2600A introduces DCS (Digital Code Squelch) circuitry, a signaling concept developed by Kenwood. DCS allows each station to have its own "private call" code or to respond to a "group call" or "common call" code. There are 100,000 different 5-digit ASCII code combinations possible. You can program in call signs up to 6 digits in the ASCII code. When operating in the DCS mode, this information can then be automatically transmitted each time the transmit key is depressed. This revolutionary feature is only the beginning! The TR-2600A also sports a high impact plastic case, that is extra rugged and scuff-resistant. The molded-in color adds to the attractive appearance. The large L.C.D. display is easy to read in direct sunlight or in the dark with a convenient lamp switch. It displays transmit/receive frequencies, memory channels, and five arrow indicators for "F LOCK" frequency lock, "REV" repeater reverse, "PROG.S" programmed scan, "MS" memory scan, "ALERT.S" aled scan. A star indicates "MEMORY LOCK-OUT" is activated, and repeater offset indicated by "+", "—", S and M. The TR-2600A has 10 memories, nine for simplex or transmit with frequency offset ±600 kHz and one (memory 0) for non-standard split frequencies. Memory scan and programmable band scan have the added convenience of "Time operated Resume" that stops on busy channel and holds for approximately 5 seconds, then resumes scanning, or "Carrier Operated Resume" that stops on busy channel and resumes when signal ceases.
Memory scan, scans only those memories in which data is stored, and memory lock-out allows you to skip selected memory channels without loss of data previously stored! Manual Scanning UP/DOWN in 5-kHz steps and programmable automatic band scan are also useful features. The TR-2600A has a built-in "S" meter on the top panel which also indicates battery level when in transmit mode. Extended frequency coverage, 142.000-148.995 MHz allows transmit capability in 5-kHz steps for simplex or repeater operation on most MARS and CAP frequencies. Receive frequency coverage includes 140.000-159.995 MHz.

These features only tell part of the story. The TR-2600A also has keyboard frequency selection, built-in 16-key autopatch encoder, "TX STOP" switch, HI (2.5)/LOW (300 mw) power switch, REV switch, "SLIDE-LOC" battery pack, high efficiency speaker, BNC antenna terminal, and all of this in an extremely compact and lightweight package!

Kenwood's TR-2600A, with D.C.S., leads the way in high technology handheld transceivers!

Optional accessories:

- TU-35B built-in programmable sub-tone encoder
- ST-2 Base Stand
- MS-1 Mobile Stand
- PB-26 Ni-Cd Battery
- DC-26 DC-DC Converter
- HMC-1 Headset with VOX
- SMC-30 Speaker Microphone
- LH-3 Deluxe Leather Case
- SC-9 Soft Case
- BT-3 AA Manganese/Alkaline Battery Case
- EB-3 External C Manganese/Alkaline Battery Case
- RA-3, 5. Telescoping Antenna
- CD-10 Call Sign Display

More information on the TR-2600A is available from authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, CA 90220.

Specifications and prices are subject to change without notice or obligation.